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ABSTRACT

This report describes results of a study of academic performance by American Indian elementary school students with limited-English proficiency (LEP). The study was designed to complement the National Longitudinal Evaluation of the Effectiveness of Services for Language Minority Limited-English-Proficient Students, which was also conducted for the Department of Education, but which did not include Native American students. This report summarizes the results of the second year of the two-year study of performance of LEP American Indian students. It includes results of two years of on-site data collection in a sample of eight projects visited. Schools visited include public schools, tribally controlled schools, and one school controlled by the federal Bureau of Indian Affairs. Researchers assessed the extent to which Indian languages and English are used at home and during school. Overall, the students participating in the study scored substantially below the national average on standardized achievement tests in mathematics and English. Indian students scored lower on math subtests than did students in the main LEP study, even though their English oral proficiency ratings were higher. Several variables are examined but the report suggests Indian students' low test scores are largely due to lack of exposure to English and lack of home support for educational achievement. A final section examines the implications and areas for further study. Graphs, tables and references are included. There is a glossary and appendixes describing the study's design, methodology, data, and the "technical advisory panel members." (Author/TES)

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ACADEMIC PERFORMANCE OF LIMITED-ENGLISH-PROFICIENT INDIAN ELEMENTARY STUDENTS IN RESERVATION SCHOOLS

YEAR TWO REPORT
OF THE
NATIONAL EVALUATION OF SERVICES FOR LIMITED-ENGLISH-PROFICIENT NATIVE AMERICAN STUDENTS

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PREFACE

This report describes the academic performance of elementary grade level limited-English-proficient Indian students attending school on or near Indian reservations. The study was designed as a complement to the "National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students" which was also conducted for the Department of Education but did not contain a sample of Native American students. The report summarizes the results of the second year of a two-year study. (The results of the first year are summarized in Rudes et al., 1988.) Included are the results of two years of on-site data collection in a sample of 8 of the 23 projects visited in the first year of the study. The data collection and analyses were performed by Development Associates, Inc., in affiliation with the Research Triangle Institute, during the years 1987-1988.

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We also thank the numerous local school principals, teachers, and other administrative personnel who were so cooperative in all aspects of the study. The burden on Title VII directors and some teachers and administrators was substantial, and the study could not have been completed without their cooperation. The quality of program evaluation ultimately rests on its data, and local school personnel were uniformly willing to help the study achieve its goals. This cooperation is greatly appreciated.

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Chapter 1. INTRODUCTION[1]

This report describes the findings from the second year of data collection and analysis for the "National Evaluation of Instructional Services for Limited-English-Proficient Native American Students."[2] It focuses on the academic performance of limited-English-proficient (LEP) American Indian students in the elementary grades in isolated rural schools located on or near Indian reservations. To obtain a sizeable population of American Indian LEP students, the study focused on schools participating in Title VII (bilingual education) projects for Native American students.

Overall, the students participating in the study scored substantially below the national average on standardized achievement tests of mathematics and English language arts. In this report, test results are examined in detail together with data on the instructional services provided to these students and the characteristics of the community, home, and school context in which instruction is provided.

Before proceeding to the presentation of study findings, a brief overview of the history of Indian education and instructional services for limited-English-proficient students in the United States will provide the context for study results.

---

[1] Definitions of special terms and symbols used in this chapter are provided in Appendix A.

[2] The primary objective of the first part of the study was to describe the instructional services provided to limited-English-proficient Native American students in the elementary grades. The findings from that portion of the study were reported upon in Rudes et al. (1988).

1A

A. HISTORY AND BACKGROUND

The relationship of the federal government and the American Indian has changed many times in the past 200 years. Since the early development of the United States, it has been official policy for the federal government to relate to Indian people on a nation-to-nation basis. Although treated as sovereign, Indian nations were subject to legal control through treaties with the federal government. By 1870, the period of treaty making had ended; encroachment onto Indian land escalated, and federal domination grew. There began a resettlement period as entire tribes were moved from their ancestral lands to regions considered unsuited for other use.

Education became a major focus of federal Indian policy, as administered through the Bureau of Indian Affairs (BIA), in 1870 when Congress first appropriated funds on a regular basis to provide educational services for certain Indian students in the United States. Prior to this, educational funding had been limited to treaty obligations and to a Civilization Fund. Currently, the Snyder Act of 1921 (25 U.S.C. 13) provides the basic authority under which the BIA provides educational and other services to federally recognized Indians. These services include direct operation of schools, support of tribally-operated schools, and financial assistance to public schools serving Indian children.

With passage of the Johnson O'Malley Act in 1934 and key amendments in 1936, the Secretary of Interior was empowered to expend federal funds through contracts with state or local agencies for the education of Indian children. The Indian Self-Determination Act of 1975 (P.L. 93-638) amends the Johnson O'Malley Act to provide for maximum Indian participation in Indian education and provides for tuition payment for Indian children. As amended, the Johnson O'Malley Act authorizes funding for supplemental programs for eligible Indian students in public schools, age three years through grade twelve, to meet their special and unique educational needs as determined by contracting agencies and local Indian education committees.

A major thread running through the history of Indian affairs has been the government policy of "assimilation," and education has been its most important single means. Federal responsibility in education developed during the treaty period when approximately 400 treaties were signed, many of which contained provisions for education. Judicial decisions, Congressional legislation, and executive orders steadily increased the federal responsibility to educate the American Indian. The actual response, however, has varied. Over time, the government has directed subsidies to mission schools, established a national Indian school system, supported state public school systems, supported alternative school systems, and enacted legislation intended to meet specific needs of Indian students.

The middle of the twentieth century (1940s-1950s) saw a period of termination of federal trust responsibility to Indian tribes and the trust relationship with certain tribes was ended. This was followed by a period of relocating Indians to urban areas for training and jobs (1940s-1960s). Many left their reservations and villages during this time.

Recently, the federal policy toward Indians has been one of self-determination. Made official during the Nixon administration, its origins go back to President Johnson's White House Task Force on Indian Affairs (appointed in 1966) and, in Congress, to the introduction by Senator McGovern (D-SD) of a concurrent resolution to increase Indian economic development and self-determination. In 1968, President Johnson sent a message to Congress recommending that Indians become involved in their own affairs, and, in 1970, Congress laid out a policy of Indian self-determination, the effects of which were felt through the 1970s. This policy was reaffirmed by President Reagan in the "White House Indian Policy Statement" of January 14, 1983.

Thus, the late 1960s was an important period in the development of Indian education. The political and social atmosphere supported positive growth. The termination period of the 1940s and 1950s had made Indian people suspicious of the federal government, but they pushed for greater federal responsibility in Indian affairs.

Systematic documentation of conditions among Indians and Alaska Natives began with the "Meriam Report" (The Problem of Indian Administration) issued in 1928; it is widely considered to be the first comprehensive review of Indian affairs. Concluding that the "first and foremost need in Indian education is to stop removing Indian children from their families," the report suggested that local day schools be emphasized in place of boarding schools. Forty-one years later, in 1969, the second major study of Indian education was released. The tone and findings of the "Kennedy Report" are reflected in its title, Indian Education: A National Tragedy - A National Challenge. The report provided documented evidence, based upon extensive investigation, that both the BIA and the public school system were failing. In both educational systems, Indian students were characterized by high dropout rates, low academic achievement, and low self-concept; there was also a lack of community and parental involvement, and a dearth of Indian teachers and school administrators. Sixty recommendations for improving Indian education were made. However, the authors asserted that before any recommendations could be acted upon:

> The Federal Government must commit itself to a national policy of educational excellence for Indian children, maximum participation and control by Indian adults and communities, and the development of new legislation and substantial increases in appropriations...

In the years following the release of the "Kennedy Report," numerous changes were made in federal legislation and policy with an aim toward improving Indian education overall. These included the enactment of laws such as the Indian Education Act (Title IV of P.L. 92-318) in 1974 and the Indian Self-Determination and Educational Assistance Act (P.L. 93-638) in 1975, as well as the amendment of existing laws such as the Johnson O'Malley Act of 1934. However, probably more important in the long run than the new amendments and laws were the changes which were wrought in the Indian community by the new policies emanating from Washington. For the first time since the federal government assumed responsibility for educating Indian children in 1865-70, Indian parents found that they could exercise an element of control over the education which their children received.

Another federal law which has had substantial impact on the education of Indian students, specifically those who are limited in their English proficiency, was ESEA Title VII (the "Bilingual Education Act"). ESEA Title VII was enacted into law in 1968. Originally designed to help local school districts develop programs of language-related services to improve the education of limited-English-proficient students by funding demonstration projects, Title VII rapidly grew into a major funding source for the general operation of such programs. It also became a major tool for districts to use in complying with the 1974 decision by the Supreme Court in Lau v. Nichols (414 U.S. 563) which stated that school districts are required, under Title VI of the Civil Rights Act of 1964, to provide limited-English-proficient students with instructional services designed to overcome their English-language deficiency. In the early years of Title VII, few projects serving Indian students were funded. However, since 1974 — the year of the Lau decision and the year of the passage of the Indian Education Act — the number of projects funded by Title VII to serve Indian students has increased significantly. Furthermore, as part of the Educational Amendments of 1978, the definition of the target population for Title VII was revised specifically to include Native American students as beneficiaries under the act.

1B B. OVERVIEW OF STUDY PURPOSE AND DESIGN

The motivation for conducting this study grew, in large part, out of the work being carried out by Development Associates for the "National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students" (hereafter referred to as the LM-LEP Study). The sample of 12,000 students participating in that study was selected to be nationally representative, and thus consisted of large numbers of Hispanic, Chinese, and Southeast Asian students, but only a small number of Native American students. Because of the special interest and responsibilities of the federal government vis-a-vis instr[illegible] services for Native American students, the U.S. Department of Education determined that a separate study, replicating the instruments and procedures of the study described above, should be carried out with a sample of Native American students.

The primary objective of the first part of this study was to describe the instructional services provided to limited-English-proficient Native American students in the elementary grades. The findings from that portion of the study were reported upon in Rudes et al. (1988). The primary objective of the second part of the study -- the focus of this report -- was to acquire a fuller understanding of the academic performance of Native American LEP students in the elementary grades attending rural schools on or near Indian reservations.

The basic research plan called for data to be collected on two cohorts of students in a national sample of schools served by Title VII projects which served Native American elementary school students.[1] The first cohort (Cohort A) consists of students who were in grade 1 during the 1985-86 school year. The second cohort (Cohort B) consists of students who were in grade 3 that year. During the first year of the study, the school sample was drawn based on a review of Title VII grant applications at the Office of Bilingual Education and Minority Languages Affairs (OBEMLA) and telephone and mail contacts with all 58 Title VII projects identified as serving primarily Native American students. Twenty-three projects were selected for on-site data collection.[2] These 23 projects included 32 schools and served a total of 1588 first and third grade Native American students who came from 16 different tribal groups, and from 18 different native language backgrounds. Although not a probability sample, the students in that study constitute a reasonable sample of Indian students attending rural schools on or near Indian reservations.

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[1] The school sample for this study was selected from among those schools which had ongoing Title VII projects serving primarily Native American students. This was done in order to facilitate the identification of schools with large numbers of limited-English-proficient Native American students. However, while all of the schools in the study had Title VII-funded projects, not all of the students in the study's student sample received Title VII services. Rather, all Native American students in grades 1 and 3 in these schools were included, regardless of the instructional services they were receiving.

[2] The contacts with all projects were for the purpose of identifying the sample of projects to be visited. Because of the high cost of data collection in Alaska, the decision was made by the U.S. Department of Education to exclude projects in Alaska from the on-site data collection for this study.

For the second year of the study, 8 of the 23 projects visited during the first year were selected for on-site data collection. These 8 projects included 11 schools and served a total of 498 second and fourth grade Native American students who came from 7 different tribal backgrounds and from 8 different native language backgrounds. All of the students included in the second year sample had also participated in the first year's data collection. The students in this sample are judged to be reasonably representative of Indian students attending rural schools on or near Indian reservations where the Indian language and culture play a significant role in community life.

In the first year of the study, two visits were made to most of the projects (only one visit was made to some very small projects). The purpose of the first visit, in March of 1986, was to familiarize Title VII project staff, school principals, and other school staff members with the study, to compile rosters of the students to be included in the study, to identify the teachers and support staff members who work with these students, and, where required, to send home parent permission forms. Also during that visit, the study's measure of academic aptitude (the Raven Progressive Matrices) was administered to students in the sample. All of the remaining study instruments (see Appendix C of Rudes et al., 1988, for a description of each) were administered during the second visit in April-June, 1986.

During the spring of the 1986-87 school year, each of the projects in the study sample was visited one time. The purpose of the visit was to administer teacher questionnaires and to administer the study's measures of academic achievement to sample students. (See Appendix B for a description of the study's teacher and student instrumentation.)

1C

C. ORGANIZATION OF THIS REPORT

Chapter 2 of this report describes the characteristics of the students and the instructional services which they receive, as well as the community and school context in which the services are provided. Chapter 3 examines the academic performance of the study students and Chapter 4 provides interpretations and explanations for the findings presented in Chapter 3.

Following these chapters are four appendices. Appendix A provides definitions for special terms and mathematical symbols used in this work. Appendix B provides the details of the study's sampling and data collection instruments and procedures. Appendix C provides more details regarding the analyses and interpretations in Chapter 4, and Appendix D provides the names and affiliations of the members of the study's panel of technical advisors.

Chapter 2. DESCRIPTION OF SCHOOLS AND INSTRUCTIONAL PROGRAMS[1]

2A A. OVERVIEW

This phase of the study encompasses Indian students in 11 isolated, rural elementary schools. The schools are in eight school districts located in six states. Two cohorts of students are involved. Students in Cohort A were enrolled in the first grade and students in Cohort B were in the third grade during the 1985-86 school year. As shown in Table 2.1 there were 278 students in Cohort A and 210 in Cohort B, with the numbers of students in the study ranging from a total of 117 students in the largest to a total of 32 students in the smallest of the school districts. Virtually all of the Indian students in each study school are from the same tribal group, with seven tribes represented overall.

2B B. SCHOOL AND COMMUNITY SETTING

2B.1 SCHOOL GOVERNANCE, LOCATION AND SIZE

Schools attended by Indian students may be classified into various types according to the governing body responsible for school administration. This study's sample includes 3 public schools, 4 tribally controlled schools[2], and 1 Bureau of Indian Affairs (BIA) controlled school.

Where a school is located can be a useful indicator of the socioeconomic status of students, and thus can be a barometer of schooling factors including the type of technological, curricular, and personnel resources available to students (Brookover & Schneider, 1975; Brookover & Lezotte, 1979; McDill & Rigsby, 1973). There are two aspects of school location which are important in considering schools which serve Indian children. The first is whether or not the school is on or adjacent to a reservation. The second is the socioeconomic level of the immediate environs. In this study all of the schools are located on or adjacent to an Indian reservation; all are in relatively remote, rural areas; and as characterized by the study's data collectors and by the principals of the study schools, all are in low-income areas.

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[1] Definitions of special terms and symbols used in this chapter are provided in Appendix A.

[2] Tribally controlled schools are those schools which are operated by a tribe under contract to the Bureau of Indian Affairs.

School size has been found to affect how students are supported and challenged in the educational process (Flagg, 1964; Morocco, 1978). For Indian students this may be particularly important because it may influence their fluency in English and how comfortable they feel in the academic program being provided in school, both being factors that may ultimately influence student achievement. Equally important may be the proportion of Indian students in the student body.

For the elementary schools that participated in the study, the number of students in grades K-6 averaged 186, with a range from 55 to 406. In six of the eleven schools, 100% of the students were Indian and in all cases Indians made up over 80% of the student body. An overview of the schools in the study in terms of grade K-6 enrollment and the percentage of Indian students is given in Table 2.2.

2B.2 COMMUNITY, SCHOOL AND HOME LANGUAGE USE

The extent of use of a local tribal language, English, and other languages varies greatly among Indian communities. There are whole communities which are nearly monolingual in an Indian language (e.g., some isolated Navajo communities); communities where just about everyone is proficient in English and the native language, and in which people use both on a daily basis

TABLE 2.1. Characteristics of participating school districts

District Code	Number of Schools in Study	No. Students in Study Cohort A		No. Students in Study Cohort B		Governance	Tribal group
902	1	52	(19%)	39	(19%)	BIA	Navajo
910	2	61	(22%)	56	(27%)	Public	Navajo
903	1	24	(9%)	23	(11%)	Tribal	Hualapai
906	1	20	(7%)	12	(6%)	Tribal	Apache
912	1	30	(11%)	18	(9%)	Public	Crow
915	1	31	(11%)	28	(13%)	Public	Metchif
920	1	24	(9%)	10	(5%)	Tribal	Lakota
926	3	36	(13%)	24	(11%)	Tribal	Choctaw
TOTAL	11	278	(100%)	210	(100%)		

TABLE 2.2. School enrollment in grades K-6

School Code	Total Enrollment Grade K-6	Percent Indian Grade K-6	Percent Indian Grade 1	Percent Indian Grade 3
9021	368	100%	100%	100%
9101	406	89	90	87
9102	144	85	83	83
9031	156	83	100	100
9062	112	100	100	100
9121	218	99	95	97
9151	290	100	100	100
9201	142	100	100	100
9261	55	100	100	100
9262	96	100	100	100
9263	55	89	88	73

(e.g., some Crow communities); and communities which are nearly monolingual in English (e.g., some Indian communities in the eastern United States). Also, the extent of use of an Indian language, English, and other languages will vary from home to home within a community.

a. Community Language Use

To assess the extent to which Indian languages and English are used as means of daily communication in the study's communities, data were collected from community leaders and a sample of parents. They were asked to identify the language most frequently used in ten types of social situations.[1] For each of these situations, respondents were asked to specify whether the language or languages most frequently heard were: (1) the local Indian language; (2) English; or (3) another language. Respondents were also given the opportunity to state 'Don't Know' for each situation.

To arrive at an index of the extent of native language use in the communities associated with each sample site, a difference score was calculated by eliminating all 'Don't Know' or 'Other Language' responses, and subtracting the total number of positive responses to 'Use English' from the total number of positive responses to 'Use Local Indian Language' for all respondents from each community. The scores could range anywhere along a scale from -10 (English is the only language heard in all of the specified social situations) to +10 (the local Indian language is the only language heard in all of the specified social situations), with a score of zero indicating that English and the local Indian language are used about equally in the community. To determine the extent of native language use, data from all of the completed forms for a site were averaged to compute the score, since it was assumed that all of the students at a site came from a single community.

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[1] The selection of specific social situations was taken from the linguistics and anthropological literature on language death and obsolescence (e.g., Dressler and Wodak-Leodolter, 1977). See Rudes _et_ _al_. (1988 page D-7) for a listing of the 10 specific situations.

The eight study communities represent a broad range of different situations with regard to use of English and the local Indian language. The project receiving the lowest rating received a score of - 7.60 (Project 915), indicating that English was used predominantly in the community, but that there was at least some use of the Indian language as well. Thus there was at least some -- even though in some cases very little -- use of the local Indian language in all of the project communities. Conversely, in the communities with scores indicating more use of the Indian language than of English, the highest score was + 503 (for Project 926), indicating some consistent use of English in all cases (see Table 2.4).

Because the extent of Indian language use in an Indian child's community is potentially an important variable and may be highly correlated with program services and their outcomes in terms of school performance in English, projects were put into three categories for some subsequent analyses. These three categories are: (1) predominant use of the Indian language in the community: possible score range of +2.5 to +10; (2) roughly equal use of the Indian language and English: possible score range of -2.499 to +2.499; and (3) predominant use of English in the community: possible score range of -2.5 to -10. The projects in each category are shown in Table 2.3, below.

TABLE 2.3. Categories of community language use based on community language use index

Category	N	Project
(1) Predominant Use of English Language in the Community. Possible Range: -2.5 to -10	1	915
(2) Roughly Equal Use of the Indian Language and English. Possible Range: -2.49 to +2.49	3	903,906,920
(3) Predominant Use of the Indian Language in the Community. Possible Range: +2.5 to +10	4	902,910,912 926

b. Language Use in the Home

More directly related to the child's language learning than the extent of use of English and the Indian language in the community is the pattern of language use found in the home. Parents who do not speak English in the home do not reinforce English skills learned in school, and may not be able to help with homework.

Therefore, parents were asked which languages were used by the mother or female guardian in the home, and by the father or male guardian. The responses were combined to create three categories of language use by parents: (1) one or more non-English languages, but not English; (2) English and at least one other language; and (3) English only.

Table 2.4 provides a project-by-project comparison of the pattern of use of English and an Indian language in students' homes with the index of Indian language use in the communities served by the projects. As the data in this table show, Indian language use in students' homes tends to be greater in communities where there is greater use in general of the Indian language.

TABLE 2.4. Home and community language use in participating districts

	Languages Used at Home by Indian Parents (Percentage of Parents)				
Project	Indian Language Only	Indian Language and English	English Only	N	Index of Extent of Indian Language Use in the Community
926	72	26	2	58	+5.03
902	16	74	10	19	+4.70
910	3	89	8	93	+3.33
912	-	-	-	0*	+2.50*
906	46	36	18	22	+1.00
903	2	82	16	50	+0.71
920	4	85	11	27	-1.00
915	0	2	98	51	-7.60

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*No parent questionnaires were completed at this site, and the index of community language use was based on data provided by school personnel and linguists familiar with the project.

c. Language Use in the School

Because Indian students' English language proficiency is an important factor in their educational attainment (Galliland, 1986), variables that affect the overall school language environment were identified. They include school district policies relative to the use of English and other languages both within and outside the instructional context, the principals' language background, the principals' attitudes toward the use of non-English languages in the school, and the use of English and other languages outside the classroom by principals, teachers, and students.

School district policy toward the use of non-English languages provides a measure of the specialized resources available to assist Indian children in the educational process. A specific district policy can also influence how instructional staff interact and react to Indian students.

The data related to school policy toward the use of languages other than English are taken from responses to questions in the School District Policy Questionnaire. In 63% of the districts, respondents indicated that there was a district policy concerning the teaching of languages other than English as a subject area in the elementary grades; Indian students may receive instruction in the oral and/or written language arts of their native language in all of the schools with an explicit policy.

The extent to which Indian students, teachers, and other staff actually use a language other than English in non-instructional situations is another useful indicator of school language environment. A composite variable was therefore created that describes the extent to which principals, teachers, and students use a language other than English outside the classroom context. The composite is composed of three items: (1) the extent to which teachers use non-English languages when interacting with Indian LEP students; (2) the extent to which Indian LEP and English-proficient students use English when interacting outside the classroom; and (3) principals' use of a language other than English with non-English speaking students. A higher score on this composite indicates greater use of a language other than English, 3.0 being the lowest score possible and 6.0 being the highest score possible. The distribution of this composite, as shown in Table 2.5, indicates that English is the primary language used in the large majority of schools.

Taken together these findings reveal a change in school climate with respect to Indian language use from that reported as late as 1969 in "The Kennedy Report." As indicated in that report and other references, the general policy of most schools, in particular Bureau of Indian Affairs schools, up to the 1970s was to discourage use of an Indian language by students, and even to punish them for its use.

TABLE 2.5. Extent of non-English language use outside the classroom by principals, teachers, and students

Composite* Score	Number of Districts	Percentage
3.0-4.0	5	46%
4.1-5.0	3	27
5.1-6.0	1	9
Missing	2	18
TOTAL	11	100%

*The composite variable was created by combining responses from the three items: (1) The extent to which teachers use non-English languages when interacting with Indian LEP students; (2) the extent to which Indian students use English when interacting outside the classroom; and (3) principals' use of a language other than English with non-English speaking students. A higher score indicates greater non-English language use, 3.0 being the lowest score possible and 6.0 being the highest score possible.

2C C. TEACHERS AND INSTRUCTIONAL PROGRAM

During visits to the project schools each teacher of each student in the study was interviewed. Utilizing a specially developed questionnaire and reporting form, these teachers provided a description of the instructional program of each of their Indian students. Subsequently, the responses from each of the student's teachers were aggregated to provide a separate description of the instructional program of each student in the study.

Students in Cohort A received about 23 hours a week of academic instruction and students in Cohort B received about 26 hours. Table 2.6 presents the data on the average number of hours per week of instruction in academic subjects for the Indian students. To help put the data for Indian students in this study into perspective, the table also shows the data from the 23 school districts in the first year of the study. In overall total hours of instruction, the Indian students in this study received more hours of academic instruction during Year 1 than did the larger sample of Indian students.

As the table shows, the major portion of the instruction for this study's students was in English language arts (approximately 58% of the weekly hours received by students in Cohort A and 47% of the hours received by students in Cohort B). For most students, English language arts instruction was divided between the regular school curriculum and special supplementary instruction in English language skills. Special instruction in English was received in both years of the study by 71% of the students in Cohort A and 43% of the students in Cohort B, with 73% of the Cohort B and 77% of the Cohort A students receiving such instruction during the study's initial year.

While about half of the instructional time for both cohorts was devoted to English language arts, overall the students received an average of less than two hours a week of instruction in the language arts of an Indian Language; and, as shown in Table 2.7, most of the students received no such instruction at all. Indeed, only 20% of the students in Cohort A and 27% of

TABLE 2.6. Mean number of hours per week of instruction in all academic subjects for Indian students

	Cohort A		Cohort B		Indian Students in 23 Year 1 School Districts[a]	
Subjects:	Year 1	Year 2	Year 1	Year 2	Cohort A	Cohort B
Regular English[b]						
Reading	6.7	5.8	5.7	5.9	5.8	4.3
Other	4.0	4.6	3.8	3.9	4.0	3.7
Regular English Total	(10.7)	(10.4)	(9.5)	(9.8)	(9.8)	(8.0)
Special English[b]						
Oral English	3.3	1.8	2.6	1.5	2.0	1.6
Other	0	0.6	0	0.7	1.0	1.3
Special English Total	(3.3)	(2.4)	(2.6)	(2.2)	(3.0)	(2.9)
Indian Language						
Reading	0.7	.4	0.5	0.8	0.4	0.3
Oral	1.3	0.3	1.0	0.9	0.9	0.6
Indian Language Total	(2.0)	(0.7)	(1.5)	(1.7)	(1.3)	(0.9)
Mathematics	4.1	4.3	5.2	5.2	4.0	4.7
Science	1.6	1.8	2.8	2.6	1.7	2.3
Social Studies	1.3	1.7	2.7	3.5	1.5	2.4
Ethnic Heritage	0.8	0.8	1.3	1.2	0.6	0.9
Total	(23.8)	(22.1)	(25.6)	(26.2)	(21.9)	(22.1)
No. of Students	250	225	185	201	576-577	472-474

[a] Indian students in the 23 school districts included in the first year of the study. The means are based on all students for whom data were obtained; when students did not receive instruction in a particular subject area, a value of zero hours was included in the mean.

[b] "Regular English" refers to the English instruction provided to monolingual, English-speaking students and other students who are proficient in English. "Special English" refers to an instructional program, such as ESL, that utilizes materials and methods especially designed for teaching English to LEP students.

TABLE 2.7. Percentage of students receiving instruction in language arts of an Indian language and the mean number of hours they receive

	Cohort A		Cohort B	
	Percent receiving instruction	Mean hours	Percent receiving instruction	Mean hours
Year 1	46%	3.7	36%	1.9
Year 2	26%	2.7	30%	4.3

the students in Cohort B received such instruction in both years of the study, and in only two of the districts did all of the students receive instruction in an Indian language.

Thus, not surprisingly, almost all the instruction offered these students was provided in English. Indeed, in one project teachers made no use of Indian language when providing instruction. Across the rest, less than 20% of the instruction in Math, Science and Social Studies in either cohort in either year was provided in an Indian language. In Cohort A the average use went from 17% in year 1 to 12% in year 2, and in Cohort B it went from 18% to 11%. On a project-by-project basis, the amount of Indian language use in academic instruction decreased each year as well. For example, in the district where use of an Indian language during academic instruction was greatest, students in Cohort A received 40% of their instruction in math, science and social studies in their Indian language in year 1. In year 2 the mean for these students dropped to 28%. Third-graders in that district received 15% of their instruction in an Indian language, and in the fourth grade such instruction amounted to only four percent.

Language of instruction is closely related to characteristics of the instructional staff, and whether or not Indian students' teachers are themselves Indian may affect students' interest and performance in school.

As shown in Table 2.8, 44% of students in Cohort A and 62% of students in Cohort B had an Indian as their main classroom teacher in at least one of the two years of the study. Although there is considerable variation in this regard within cohort across the eight districts, at least some students in all of the districts had at least one Indian teacher, thus indicating the presence of Indian professionals on the teaching staff of each of the study schools. Similarly, the table shows that most students -- and at least some in every district -- had at least one teacher who used the local Indian language when communicating with students outside of class.

Whether students receive most of their academic instruction from a professional teacher as opposed to a classroom aide may also influence student performance. Presumably it is preferable for students to be instructed by certified teachers, but often students with limited proficiency in English receive substantial portions of their instruction from an aide. To determine the extent to which this was true in this study's sample the main classroom teachers of each of the students were asked to indicate whether "when Native American students receive instruction in areas such as math, science and social studies ... (a) the classroom teacher provides most/all; (b) the aide provides most/all, or (c) both teacher and aide share this instruction equally." Teachers were also given the opportunity to indicate none of the above was the case. As shown in Table 2.9, a substantial portion of the academic instruction provided to a large proportion of the students, particularly in year 1, was provided by an aide, and in two of the districts an aide provided all of the instruction to the first graders in the study's initial year.

TABLE 2.8. Percentage of students whose main teacher is Indian and percentage with a teacher who used an Indian language with students outside of class

	Percentage of students' whose main teacher is Indian						Percentage of students with a teacher in Year 1 or 2 who used an Indian language with students	
	Cohort A			Cohort B				
District Code	Year 1	Year 2	Year 1 or 2	Year 1	Year 2	Year 1 or 2	Cohort A	Cohort B
902	33%	64%	62%	53%	0%	53%	94%	47%
910	51	35	35	68	34	50	35	55
903	4	76	68	0	100	100	88	100
906	0	-	0	100	100	100	0	100
912	100	27	100	94	39	94	70	94
915	0	0	0	61	46	75	0	57
920	0	100	83	-	0	0	100	0
926	0	0	0	38	47	38	8	42
-	27	41	44	55	43	67	51	61

TABLE 2.9. Percent of students who received a substantial amount of academic instruction from a classroom aide

District	Cohort A		Cohort B	
Code	Year 1	Year 2	Year 1	Year 2
902	63.5%	100%	0%	0%
910	100*	32*	76	32
903	100*	0	100	0
906	0	-	0	0
912	50*	0	6*	0
915	100	0	0	0
920	0	100*	0	0
926	0	100	0	0
TOTAL	51%	47%	36%	185

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*Most or all is from an aide.

Chapter 3. CHARACTERISTICS AND PERFORMANCE OF INDIAN STUDENTS[1]

3A A. STUDENT CHARACTERISTICS

The students in the study represent six Indian tribes and virtually all (99%) were born on or near an Indian reservation. Residence on or near a reservation is an important variable in understanding Indian students' academic performance because of the important cultural and linguistic influences on Indian children of life on the reservation. For most students, their current school was the only school they had ever attended. Almost all (96%) had attended kindergarten and 76% had attended at least one year of a pre-school program. The mean age for first-grade students in the study (as of January 15, 1986) was 7.1 years (S.D.=.52) and 9.2 years (S.D.=.65) for third-grade students. These are in the range of the ages one would expect for first and third-grade students.

3A.1 ORAL LANGUAGE PROFICIENCY

To get a uniform measure of English and Indian-language proficiency for students across all projects in the study, arrangements were made for teachers of students in the study sample to complete an instrument entitled the Student Oral Proficiency Rating (SOPR).[2] On this instrument, students were rated by teachers who were proficient in the language being rated, whether English or the Indian language, and who were also familiar with the student's use of that language within a range of classroom situations. Students were rated on a scale of 1 to 5 in five categories of oral proficiency: comprehension, fluency, vocabulary, pronunciation, and grammar. A rating of 1 indicated minimal or no proficiency in that category of language proficiency while a rating of 5 indicated ability equivalent to that of a monolingual speaker of the same age as the student being rated. A total score was calculated by summing the scores for the five individual categories; the total score possible thus ranged from 5 to 25 with the exception that for all the students in one site who were known never to have heard an Indian language the total score of 5 was changed to 0 (or to 4 for use in some analyses).

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[1] Definitions of special terms and symbols used in this chapter are provided in Appendix A.

[2] The SOPR is a rating instrument that is a slightly modified form of the Student Oral Language Observation Matrix (SOLOM), an instrument used in California to assist in student placements. The SOPR provides a measure of student proficiency based on actual comprehension and production within formal and informal classroom discourse situations. The data that form the basis of the teacher ratings of student oral proficiency are the numerous classroom discourse situations in which the teacher and the student have used the language of interest. Thus the data used are drawn from extensive daily interaction with the student and are not limited only to selected topic areas or selected language skills. Since no specific assessment situation is required for the rating, student reticence or test-wiseness is much less a factor in the ratings. For these reasons, the SOPR ratings are expected to be more valid for the study purposes than any scores obtained through the use of the tests available commercially. Also, the general format of the SOPR is such that it can be used for all language groups, provided that there is a qualified teacher available to rate the student in the native language. (For additional discussion see Rudes et al., 1988, and Zehler, 1985.)

The means of the total scores for the English and Indian language ratings are presented in Table 3.1. As the table shows, the language proficiency of the students varies by district, there being greater variation among districts with respect to the Indian language than English. Overall, the students may be considered as having a functional, but not fully fluent, proficiency in English which was a little greater for third-graders than first-graders. Proficiency in an Indian language is rather limited for both first and third-graders, with students in one of the projects having no proficiency at all.

TABLE 3.1. Mean English and Indian language SOPR scores

District Code	English						Indian Language					
	Cohort A			Cohort B			Cohort A			Cohort B		
	Mean	SD	No.	Mean	SD	No.	Mean	SD	No.	Mean	SD	No
902	17.7	5.16	51	17.1	6.01	38	16.8	5.88	47	18.1	6.54	39
910	19.8	2.68	39	19.2	3.00	40	15.5	4.50	39	17.2	6.17	40
903	19.3	2.33	24	20.6	2.25	23	12.5	4.67	24	16.3	5.70	23
906	15.6	3.72	16	19.2	2.44	9	17.8	7.14	16	12.4	7.48	7
912	20.6	4.74	30	22.2	3.60	16	14.8	8.55	30	18.7	6.35	16
915	21.2	3.49	28	20.4	2.63	28	4.0	0	29	4.0	0	15
920	20.6	2.36	24	24.6	.52	10	14.8	4.92	24	14.8	6.97	10
926	17.2	3.81	36	17.4	4.20	24	17.5	4.84	36	19.8	3.80	24
TOTAL	19.0	4.15	248	19.5	4.26	188	14.4	6.78	245	16.3	7.00	174

3A.2 ACADEMIC APTITUDE

To provide a measure of the child's academic ability which would not be operationally dependent on a knowledge of the English language the Raven Progressive Matrices Test was used. A review of the distribution of total scores on the Raven for grades 1 and 3 indicates that a very large part of the entire range of possible scores is covered. When scores on the Raven are compared to national percentiles for a cross section of students of the same age in the US, the Indian students in the sample score at about the national norm. As shown in Table 3.2, the mean score for the students in Cohort A is equivalent to the 58th percentile and the mean score for Cohort B is equivalent to the 45th percentile (Raven et al., 1986). As the table also shows, there is some variation among the sites. Relatively low mean scores for students in both cohorts are found at site 903 and 920. Similarly, the mean score is quite low for cohort B students at site 906. While we do not have the data to clearly explain the reason for these particularly low means, we suspect it is related to the fact that the communities served by these sites are all extremely isolated, traditional, and poor, even in comparison to the other sites in this study, and that in district 906 students may leave the tribally controlled study school for the nearby public school after they have increased their English language ability.

TABLE 3.2. Mean Raven scores and comparison of scores with the publisher's national sample

District Code	Cohort A					Cohort B				
	Mean Score	SD	No.	Mean Age	%ile	Mean Score	SD	No.	Mean Age	% ile
902	19.8	5.27	50	7yr2mo.	59	29.7	7.84	35	9yr3mo.	42
910	20.8	4.86	58	7-1	64	25.6	3.36	48	9-1	40
903	16.6	4.85	24	7-3	35	24.5	8.05	22	9-4	27
906	21.2	6.11	16	6-11	66	26.5	9.74	8	9-4	33
912	23.5	5.33	30	7-1	77	32.7	7.28	15	9-2	62
915	19.6	4.61	29	7-1	58	27.6	7.61	27	9-1	43
920	15.3	6.36	24	7-2	35	27.5	9.18	10	9-8	36
926	19.0	5.32	34	7-2	55	25.8	9.08	24	9-0	40
TOTAL	19.7	5.63	265	7-1	58	27.2	8.18	189	9-2	45

Not surprisingly, further analyses indicates that Raven scores definitely are related to mastery of English. The correlation between Raven total and English SOPR is .17 for grade 1 and .30 for grade 3; these correlations are not high, but they are statistically significant. Bearing in mind that the Raven is a nonlanguage test, it seems unlikely that mastery of English is among the causal factors accounting for high Raven scores. Rather, we surmise, there is some causality in the opposite direction; students with high Raven scores tend to have a high level of academic aptitude including the kind of verbal ability that is useful in learning English. There appears to be no such causal relation for the Indian-language SOPR, however. The explanation is probably that all the students, regardless of the extent to which they have been exposed to their tribe's Indian language, either in or outside of school, are under some pressure from the school to acquire proficiency in English (or if they are already proficient in English to continue improving their skills in it). Conversely, there is not likely to be uniform pressure on students to augment their skills in the tribal language.

3A.3 HOME ENVIRONMENT

Family structure and parents' educational levels are also factors which have been shown to be related to academic achievement (Laosa, 1982a; Laosa, 1982b; Henderson, 1981; Lambert, 1977; National Center for Education Statistics, 1978; Rosenthal, Baker & Ginsberg, 1983). There is also considerable evidence to suggest that parents' interest and involvement in education can affect the academic outcomes of their children (Gore, 1974; Kjolseth, 1972; Cervantes, 1978; Cervantes, Baca, & Torres, 1979). Therefore, a series of questions was asked relating to these areas.

The children in the study came from moderately large families. Overall, the mean family size of students in the study (both Cohort A and B) was 5.9 members, with only moderate variation among school districts (from 7.8 to 5.1 members). With respect to education, the fathers of Indian children had completed about a half year more of schooling than mothers, but the mean for neither was above the 11th grade (i.e., 10.17 years for mothers and 10.75 for fathers). Again, there was relatively little variation across communities with respect the the years of schooling of either mothers or fathers of the Indian students in the study.

The academic orientation of a family can also be inferred from various activities in a household. Parents with high educational expectations may require that children spend more time on homework, may read more to their children, or may encourage more reading. Table 3.3 shows the mean number of hours per week which Indian parents reported that their children spent doing homework, reading (other than homework), and being read to. As is shown, on the average these Indian students spend a little over three hours a week on homework, but there is considerable variation from site to site.

Parents were also asked to estimate the amount of time their children watched TV or VCR programs in English, listened to the radio in English and listened to the radio in another language. As shown in Table 3.4 there was considerable difference between districts but little difference across the two cohorts. Total listening and viewing time equaled an average of 12.3 hours per week.

TABLE 3.3. Mean hours per week spent by Indian students doing homework, reading (other than homework), and being read to

District Code	Doing Homework				Reading				Being Read to			
	Cohort A		Cohort B		Cohort A		Cohort B		Cohort A		Cohort B	
	Hrs	N	Hrs	N	Hrs	N	Hrs	N	Hrs	N	Hrs	N
902	1.5	8	2.8	8	1.9	8	1.5	8	1.0	8	1.1	8
910	3.2	34	3.1	40	1.9	34	2.6	40	2.0	34	1.6	40
903	4.5	24	3.8	23	3.8	24	2.9	23	3.5	24	2.4	23
906	1.5	13	3.0	5	.9	13	1.0	5	1.0	13	.2	5
912	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
915	1.6	20	3.1	19	2.6	20	3.1	19	2.4	20	.7	19
920	1.9	17	2.3	9	3.1	17	1.2	9	2.8	17	2.1	9
926	4.7	30	5.0	22	1.5	30	1.6	22	1.0	30	.6	22
TOTAL	3.1	146	3.5	126	2.3	146	2.3	126	2.0	146	1.4	126

TABLE 3.4. Mean hours per week spent by Indian students watching TV or VCR programs in English, listening to radio programs in English, and listening to radio programs in another language

	Cohort A				Cohort B			
District Code	TV/ VCR	English Radio	Other Radio	N	TV/ VCR	English Radio	Other Radio	N
901	4.1	1.4	.4	8	7.1	3.6	1.6	8
910	8.4	2.9	.8	34	5.2	2.3	.7	40
903	9.9	3.1	.3	24	10.4	2.4	.1	23
906	2.4	.4	0	13	5.4	1.8	0	5
912	NA	NA	NA	-	NA	NA	NA	-
915	11.8	3.3	0	20	15.1	2.5	.1	19
920	9.9	4.7	1.4	17	7.4	2.1	1.0	9
926	13.5	3.1	.1	30	11.6	3.4	.9	22
TOTAL	9.6	2.9	.5	146	9.1	2.6	.4	126

The parents' interest in schooling is also reflected in their perceptions of the relative importance of the education which the child receives in school versus the education which the child receives in the home, in the community, and elsewhere outside the school. When asked their opinion on this issue, 94% of the parents stated that they considered the education their children receive in school to be "very important."

Parents' perceptions of the quality of the education their children received were somewhat lower than their assessment of its importance. Overall, 13% rated the education their children were receiving as fair to poor, 32% as good, 30% as very good, and 25% as excellent.

Finally, the academic orientation of a family may be reflected in the expectations which parents have for the amount of schooling which the child will probably complete. The parents of 45% of the Indian students expected their child to go on to college, including 8% who expected their child to go to graduate school. Less than 3% of the parents expected their child to go to school through no more than the 9th grade.

3B

B. ACADEMIC PERFORMANCE

The vocabulary, reading comprehension, and mathematics subtests of the Stanford Achievement Test (SAT) were selected as the principal measures of academic achievement for this study.[1] The overall study design called for testing students in the spring of 1986 and the spring of 1987, and the results of analyzing the two years of test data are presented below.

A comparison of the Indian students with national norms is presented in summary form in Table 3.5, and in more detail in Tables 3.6 and 3.7. As the tables show, overall the performance of the Indian students is quite low on all of the tests, ranging from the 15th percentile to the 35th. Perhaps even more disturbing is the trend of the scores across the four grades. Figure 3.1 graphically shows this trend. The scores for vocabulary, reading and math relative to national norms all decline sharply from the 1st to the 2nd grade. From the 3rd to the 4th grade there is neither a decline nor improvement with respect to vocabulary or math, and although there is a relative improvement in reading in terms of the actual number of items correct the difference is an improvement of less than two points (see Table 3.6b).

TABLE 3.5. Summary of SAT percentile scores for vocabulary, reading and math

	Mean Percentile			
	Cohort A		Cohort B	
	Year 1	Year 2	Year 1	Year 2
Vocabulary	26%	15%	19%	8%
Reading	28	20	25	35
Total Math	24	19	27	27

TABLE 3.6(a) SAT Vocabulary and reading scores and national percentiles: Cohort A

	SAT English Scores															
	Vocabulary								Reading							
	Year 1				Year 2				Year 1				Year 2			
District Code	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile
902	48	16.5	4.32	.16	47	14.6	5.05	.11	48	16.3	6.90	.13	48	16.6	7.47	.15
910	39	17.2	4.15	.19	61	16.0	3.38	.15	39	19.5	5.50	.22	60	16.7	6.83	.15
903	23	19.1	3.77	.26	24	15.7	3.37	.14	23	22.4	8.04	.28	24	17.8	8.24	.17
906	20	15.7	3.50	.13	20	13.7	2.13	.8	20	17.4	6.56	.16	20	17.4	7.87	.16
912	30	22.5	5.49	.41	21	18.8	4.41	.26	30	28.5	9.10	.44	22	27.5	8.34	.39
915	30	23.4	6.47	.46	31	18.7	6.00	.26	30	24.8	9.16	.35	31	22.5	8.22	.26
920	23	23.1	5.39	.44	20	18.5	4.49	.25	23	29.4	8.16	.46	19	24.6	8.46	.30
926	35	18.2	5.24	.22	34	14.7	5.63	.11	35	23.3	8.10	.31	34	20.0	8.90	.21
TOTAL	248	19.2	5.60	.26	258	16.1	4.78	.15	248	22.2	8.92	.28	258	19.5	8.53	.20

TABLE 3.6(b) SAT Vocabulary and reading scores and national percentiles: Cohort B

	SAT English Scores															
	Vocabulary								Reading							
	Year 1				Year 2				Year 1				Year 2			
District Code	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile
902	35	12.86	4.39	.11	39	12.33	4.35	.9	35	26.66	9.30	.21	37	26.84	11.07	.27
910	27	16.15	6.21	.22	55	18.84	8.61	.30	39	24.08	8.69	.17	56	32.73	12.99	.39
903	22	16.77	4.09	.24	23	15.74	4.53	.18	22	34.64	9.14	.37	23	31.25	10.23	.37
906	8	12.50	4.87	.10	12	10.42	4.36	.5	8	23.25	8.60	.16	12	18.67	5.18	.12
912	6	18.50	5.21	.31	16	16.31	4.44	.20	17	36.53	10.13	.42	18	32.89	11.60	.40
915	28	19.04	6.30	.33	28	19.64	5.83	.34	29	30.46	12.97	.28	28	34.96	13.95	.45
920	10	17.40	4.99	.27	9	16.22	5.45	.20	10	33.00	12.72	.33	10	32.40	10.79	.39
926	24	11.96	4.10	.9	24	13.33	5.04	.11	24	26.29	11.97	.21	24	28.58	10.55	.31
TOTAL	160	15.38	5.66	.19	206	15.93	6.74	.19	183	28.72	11.11	.25	208	30.53	12.18	.35

TABLE 3.7(a) SAT Math scores and national percentiles: Cohort A

	Concept of Number								Computation and Application							
	Year 1				Year 2				Year 1				Year 2			
District Code	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile
902	48	18.17	5.04	.17	42	16.95	5.98	.20	48	26.44	7.08	.24	36	37.83	11.69	N/A
910	39	21.82	4.57	.30	58	16.09	4.73	.17	39	28.97	6.99	.32	60	37.07	9.87	N/A
903	23	15.96	3.71	.10	24	15.98	6.60	.17	23	22.35	6.34	.15	24	36.54	15.34	N/A
906	20	17.80	6.21	.15	20	16.20	5.67	.18	20	22.20	8.38	.14	20	35.30	12.75	N/A
912	29	22.17	5.06	.32	22	19.23	5.40	.29	30	25.23	8.89	.21	22	35.77	9.11	N/A
915	30	22.20	5.71	.32	31	18.65	7.15	.27	30	30.63	6.53	.38	31	41.84	14.84	N/A
920	23	24.65	4.01	.43	19	22.58	3.42	.44	23	30.48	6.55	.37	20	41.30	8.86	N/A
926	35	18.29	5.26	.17	34	17.41	6.97	.22	35	24.00	9.41	.19	34	32.12	13.26	N/A
TOTAL	247	20.09	5.57	.22	250	17.49	6.06	.22	248	26.51	8.07	.25	247	37.13	12.21	N/A

TABLE 3.7(a) SAT Math scores and national percentiles: Cohort A (Cont.)

	Total Math							
	Year 1				Year 2			
District Code	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile
902	48	44.60	11.48	.21	35	55.97	66.19	.19
910	39	50.80	10.97	.32	57	53.83	13.25	.17
903	23	38.30	9.14	.13	24	52.42	21.35	.15
906	20	40.00	14.21	.15	20	51.50	17.99	.15
912	29	47.83	12.87	.27	22	55.00	13.33	.19
915	30	52.83	11.33	.36	31	60.48	21.41	.25
920	23	55.13	9.11	.40	19	63.16	11.33	.29
926	35	42.29	13.66	.18	34	49.53	19.25	.13
TOTAL	247	46.65	12.72	.24	242	54.89	17.25	.19

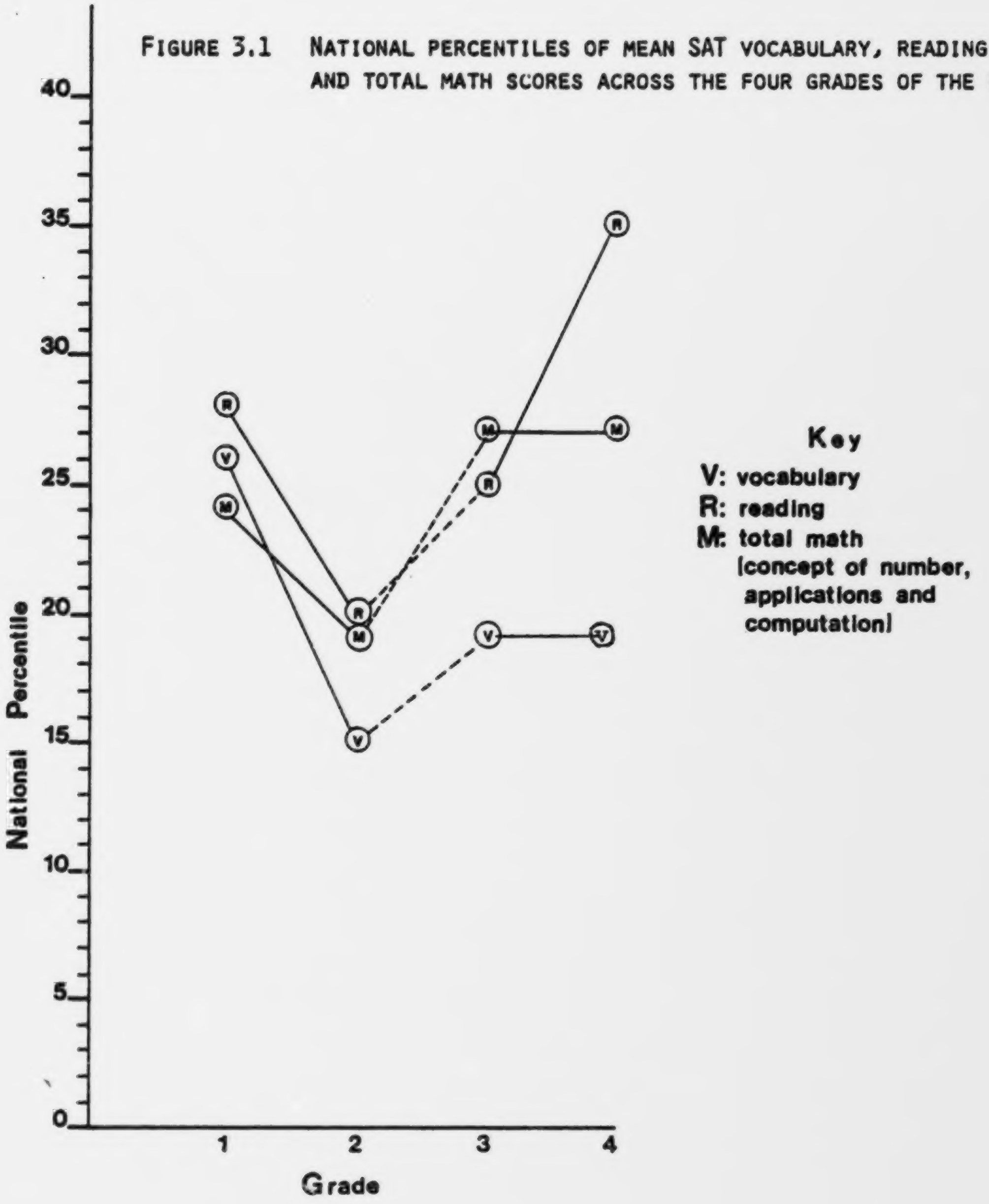
TABLE 3.7(b) SAT Math scores and national percentiles: Cohort B

	Concept of Number								Computation							
	Year 1				Year 2				Year 1				Year 2			
District Code	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile
902	35	18.09	5.23	.31	37	13.54	5.01	.24	35	25.74	9.09	.33	37	18.73	8.71	24
910	38	20.03	6.23	.41	55	18.27	7.51	.44	39	24.08	6.94	.29	56	22.43	7.74	34
903	22	18.82	5.27	.34	23	14.61	3.94	.29	22	25.77	4.63	.34	1	13.00	-	11
906	8	15.63	8.98	.23	12	11.33	5.26	.16	8	16.25	10.93	.12	12	10.92	4.46	8
912	17	20.82	4.17	.44	18	16.44	4.62	.36	17	20.65	6.76	.21	17	24.41	7.33	40
915	28	17.04	4.93	.27	28	16.11	6.53	.35	28	24.43	7.95	.30	28	21.54	8.31	32
920	10	21.10	4.01	.45	10	17.50	6.06	.41	10	19.90	7.46	.19	10	25.70	6.22	43
926	24	14.25	6.26	.19	24	13.79	6.71	.25	24	18.67	9.30	.16	24	17.75	9.25	22
TOTAL	182	18.23	5.90	.32	207	15.61	6.39	.33	183	23.06	8.25	.26	185	20.51	8.57	29

TABLE 3.7(b) SAT Math scores and national percentiles: Cohort B (Cont.)

	Math Applications								Total Math							
	Year 1				Year 2				Year 1				Year 2			
District Code	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile	N	$\bar{x}$	σ	%ile
902	35	15.43	6.72	.24	39	16.67	8.56	.26	35	60.26	18.00	.29	37	48.22	19.37	.21
910	38	15.24	5.58	.20	56	16.98	6.98	.27	38	59.47	13.79	.28	55	57.93	19.23	.33
903	22	20.32	4.89	.36	23	17.22	5.88	.27	22	64.91	11.31	.36	1	48.00	-	.21
906	4	9.50	2.08	. 7	12	10.58	6.37	.11	4	29.75	12.69	. 4	12	32.83	14.17	. 8
912	16	20.69	5.17	.38	16	20.81	7.64	.37	16	63.69	11.99	.34	15	60.53	17.83	.36
915	28	17.61	7.05	.28	28	23.18	8.15	.45	28	59.07	16.07	.27	28	60.82	20.22	.36
920	10	19.50	5.46	.34	10	21.00	6.58	.38	10	60.50	16.04	.30	10	64.20	15.34	.40
926	24	15.50	9.58	.21	24	15.87	9.53	.24	24	48.42	22.64	.16	24	47.42	23.99	.20
TOTAL	177	17.12	6.68	.26	208	17.77	8.13	.29	177	58.51	17.14	.27	182	53.86	20.77	.27

FIGURE 3.1 NATIONAL PERCENTILES OF MEAN SAT VOCABULARY, READING AND TOTAL MATH SCORES ACROSS THE FOUR GRADES OF THE STUDY



The decline in SAT scores relative to norms differed for different levels of English oral proficiency. Table 3.8 presents the SAT means and the corresponding percentiles for students classified on the basis of English SOPR category. The "Gain" rows in this table show the year 2 minus year 1 difference in percentiles.

As Table 3.8 shows, the percentile differences for Cohort A are all negative; in other words there appears to be a systematic loss between grades 1 and 2. Furthermore, the high SOPR category (23-25) generally shows larger declines in percentile than the two lower categories; this is probably partly due to regression towards the mean, resulting from the fact that the variable on the basis of which the students were categorized for this analysis -- i.e. English SOPR -- has a higher correlation with year 1 performance than with year 2. The correlations between SAT scores and English SOPR are shown in the last column of Table 3.8 to facilitate comparison. The largest percentile loss for the high SOPR group is 18 points (for Cohort A Vocabulary); this coincides with a sharp drop in correlation with SOPR from .60 to .46. However in view of the overall pattern of decline in percentiles from year to year it seems most unlikely that regression towards the mean is the sole explanation. The students who start out low in terms of SOPR also start low on the SAT, and they continue low. At best they are barely holding their own; the high SOPR students, who do not have much of a deficit, if any, in English in year 1 actually lose ground in year 2. For Cohort B (i.e., the change from grade 3 to grade 4) the results are slightly better, in the sense that at all three SOPR levels the students seem to be improving in Reading Comprehension and holding their own in the other two subjects. The Cohort B year 1-to-year 2 changes in terms of percentile level seem to be fairly uniform for the different SOPR levels. The reason for the difference between the results for Cohorts A and B is not evident; it may be due to chance.

On a district by district basis the Cohort A results are no more encouraging. As shown in Table 3.9 which provides a summary of the individual district percentiles in vocabulary, reading and math across the two years, the percentiles corresponding to project means are low. Of the 96 means (8 districts x 3 subtests x 2 years), 7% are in the 0-10 category and 38% are

TABLE 3.8 SAT mean rights scores and corresponding percentiles for students in three categories in terms of English SOPR; also correlation between SAT score and English SOPR

Dependent variable (SAT)	Cohort	Year	Grade	Eng.SOPR 5-17			Eng.SOPR 18-22			Eng.SOPR 23-25			r between SAT and Eng.SOPR
				M	%ile	N	M	%ile	N	M	%ile	N	
Vocab	A	1	1	15.1	11	65	19.4	27	110	24.1	49	50	.60
		2	2	13.3	8	65	16.0	15	110	19.7	31	50	.46
		Gain			-3			-12			-18		
	B	1	3	11.3	8	35	15.7	20	85	17.9	29	36	.42
		2	4	11.8	8	35	15.6	18	85	18.3	28	36	.40
		Gain			0			-2			-1		
Rdg.Comp	A	1	1	16.0	12	65	22.7	29	109	28.9	45	50	.50
		2	2	14.2	10	65	20.7	22	109	25.7	33	50	.49
		Gain			-2			-7			-12		
	B	1	3	19.1	10	40	28.4	24	94	37.7	44	45	.56
		2	4	22.1	18	40	30.1	34	94	38.7	53	45	.48
		Gain			8			10			9		
Math Total	A	1	1	38.0	13	57	48.5	28	102	56.1	43	49	.56
		2	2	42.2	7	57	56.2	19	102	65.7	33	49	.45
		Gain			-6			-9			-10		
	B	1	3	45.4	13	37	57.6	26	77	67.8	40	35	.49
		2	4	42.1	15	37	53.6	27	77	66.9	44	35	.46
		Gain			2			1			4		

below the 20th percentile in terms of national norms. This is a poor showing in view of the fact that school means are expected to cluster more tightly around the overall mean than do individual students. How much of the sub-par performance in math is due to deficits in the English language skills (vocabulary and reading) is not entirely clear; but what is clear is that progress in reducing those deficits (with the possible exception of reading skills for Cohort B) is discouragingly slow.

TABLE 3.9. Number of projects in various SAT percentile categories for vocabulary, reading and math*

	Cohort A			Cohort B		
Percentile	Vocabulary	Reading	Total Math	Vocabulary	Reading	Total Math
0-10	1	0	0	4	0	2
11-19	7	6	9	3	3	1
20-29	5	4	4	5	4	6
30-39	0	4	2	4	6	6
40-49	3	2	1	0	3	1

*Categories combine the two years of the study; each project was counted twice for each subtest (i.e., Year 1 and Year 2)

Chapter 4. POSSIBLE EXPLANATIONS FOR INDIAN STUDENTS' LOW ACHIEVEMENT TEST SCORES

4A A. INTRODUCTION

The major finding from the previous chapters is that the academic achievement test scores of the Indian students are extremely low and that over the two years of the study they either got worse or stayed the same. This is in spite of the fact that these students have academic aptitudes equivalent to published national norms and are attending schools which receive federal grants to provide special, language-related instructional services to these students. While these results are substantially worse than results from the most recent major study of Indian students in schools receiving funds through the federal Indian Education Act (Young et al., 1983), the two samples are quite different. All the students in this study were residents of relatively traditional, isolated communities on or near reservations, while the earlier study included many Indian students living in urban and suburban locales.

The purpose of this chapter is to report on various analyses undertaken to explain, or at least suggest reasons for the low scores. The test results for these students in the first year of the study are essentially the same as those for the larger sample of Indian students of which they are a part (Rudes et al., 1988), and there is no reason to believe the second year results for the larger group would not have been similar as well. Thus, the data in this study suggest that Indian students have serious academic deficiencies which their schools do not seem to correct. Clearly a serious problem exists, and, although beyond the original purpose of this study, it is important to use the data at hand to better understand the nature of that problem and to provide direction to future inquiries.

4B

B. SUMMARY OF EXPLANATORY ANALYSES

In order to gain additional insights concerning the Stanford Achievement Test results, a series of descriptive and inferential statistical analyses were performed. These analyses fell into four basic categories:

- multiple regression analyses, in which various combinations of variables were used to predict outcomes on Year 1 and Year 2 SAT scores in Vocabulary, Reading Comprehension, and Math Total;
- path analyses, in which more complex causal models were developed and tested, in order to understand causal sequences leading to Year 2 SAT outcomes;
- analyses of covariance, in which selected predictor variables were used as main effects in analyses of variance of Year 2 SAT scores, and other variables were used as covariates (in order to study interactions of key variables); and
- focused subgroup analyses, in which the Year 2 SAT scores of subgroups of students homogeneous on such variables as Raven (aptitude) and English SOPR (oral proficiency) were analyzed using simple comparison of means.

For logistical and statistical reasons, only a limited number of predictor variables could be used for these analyses (especially the path analyses, analyses of covariances, and focused subgroup analyses). In general, the variables used could be placed into five categories:

(1) Student Characteristics

  (a) Raven Progressive Matrices (total adjusted score)

  (b) English SOPR total score

  (c) Indian SOPR total score

  (d) Year 1 SAT adjusted scores in Vocabulary, Reading Comprehension and Math Total

  (e) Pre-kindergarten school experience (no, yes)

(2) Instructional Variables

  (a) Hours per week of instruction in English, special English, English reading, or mathematics

  (b) Percentage Indian language use in math, science, social studies, and ethnic heritage (or math only)

(3) School/Community Variables

- (a) Percentage of LEP students in grades K-6
- (b) Percentage of students who sometimes speak an Indian language in or around the school (categorized on a six-point scale)
- (c) Extent of Indian language use outside of classrooms by students, teachers, and principal (composite)
- (d) Indian language use in the surrounding community (composite)

(4) Teacher Variables (M = average for main teachers in each of two years, A = average for all teachers in two years)

- (a) Use of Indian language outside of classroom (M,A)
- (b) Self-identification as Native American (M,A)
- (c) Years of teaching experience (M)
- (d) Whether teacher (as opposed to an aide) provides most of instruction in math, science, and social studies (M)
- (e) Proportion of instructors who are aides, not teachers (A)

(5) Home/Family Variables

- (a) Parents' years of education (composite with more educated parent weighted three times as heavily)
- (b) Parents' use of English in the home (composite)
- (c) Presence of English language newspapers and magazines in the home (composite)
- (d) Hours per week child spends:
  - being read to
  - reading
  - doing homework
  - watching/listening to TV/radio programs in English
- (e) Parent's ratings of importance of school (categorized on a three point scale)
- (f) Parent's interest in child's education (composite)
- (g) Parent's expectations for how far the child will go in school (categorized on a five point scale)

4C C. SUMMARY OF ANALYTIC RESULTS

There are a variety of potential explanations for the performance of Indian students, and data relevant to many, but not all, of them were collected as part of this study. Those for which data are available and analyses were performed can be thought of in terms of the following five categories: (1) the academic aptitude of the students; (2) the English language proficiency of the students; (3) the amount and language of instruction; (4) characteristics of the instructional staff; and (5) characteristics and expectations of students' families. Results from the analyses pertaining to these categories of potential explanation are summarized below, with more detailed descriptions of the analyses involved provided in Appendix C of this report.

4C.1 ACADEMIC APTITUDE

One obvious possible explanation for low achievement test scores is the academic aptitude of the students. If the students' aptitude is low, one would expect low performance on achievement tests. However, as described in Chapter 3, the mean scores for students in this study were not particularly low. Indeed, they were equivalent to the scores of the publishers' large and presumably representative United States normative group.

More specifically, two versions of the Raven Test of Progressive Matrices were used as the measure of academic aptitude in this study. The Raven was selected because it is not dependent on language ability and it is widely regarded as culturally appropriate for Indian students (for example, see the discussion in Gilliland, 1986, p. 8). That there is an appropriately broad distribution of test scores across the study's students, and as would be expected, the Raven scores are positively correlated with the achievement test scores of the study's Indian students (they are even a better predictor for students in Cohort B than Cohort A) provides further support for the appropriateness of the test. Thus, since the scores of students in Cohort A of this study were at the 58th percentile of the normative group and students in Cohort B were at the 45th percentile, it is clear that academic aptitude does not explain the low achievement test scores.

4C.2 ENGLISH LANGUAGE PROFICIENCY

A second possible explanation for low achievement test scores is a lack of English language skills among the Indian students. Low English language proficiency would be expected to impact especially on the Vocabulary and Reading Comprehension subtests of the SAT (but less so on Math subtests). Mean English SOPR scores were in fact considerably below native speaker levels (Cohort A = 19.5, Cohort B = 19.9 out of 25) and were correlated with SAT subtests in both years (see Table 4.1).

TABLE 4.1. Correlations of English SOPR and SAT scores

	Cohort A			Cohort B		
	Reading	Vocab.	Math Total	Reading	Vocab.	Math Total
Year 1	.492	.609	.530	.567	.380	.449
Year 2	.486	.459	.451	.450	.395	.408
n	182	182	161	140	122	113

The correlations between English SOPR and SAT scores were also less for Year 2 than for Year 1 (except for Cohort B Vocabulary subtests). This is the pattern which would be expected if schools were teaching English skills in Year 2 which are relevant to the SAT tests, and thus the English SOPR was a less valid measure of English proficiency in Year 2 than in Year 1.

Low SAT scores can only partially be attributed to low English proficiency, however. Low English proficiency should have had more impact on Reading Comprehension and Vocabulary scores than on Total Math scores, yet Indian students scored equally low on all tests (in comparison to national norms). Also, the mean English SOPR scores of Indian students were above those of LM-LEP students in the main LEP study (Young et al., 1986), yet students scored lower on Math SAT tests.

4C.3 INSTRUCTION

A third possible explanation of low SAT scores concerns the amount or nature of instruction. Two types of variables were studied in this regard: (1) the amount (hours per week) of instruction in specific subjects; and (2) the extent to which the Indian language was used in instruction.

Although there were a number of simple correlations between instructional variables and outcomes, these correlations were lowered to near zero once student background characteristics were controlled for. Thus, for example, students with low English SOPR scores received more special English instruction and scored lower on SAT tests. The negative relationship between special English instruction and SAT scores was artificially produced by a pedagogically sound approach of providing special English instruction to those most in need.

The results of our causal analyses thus showed very few statistically significant relationships between instructional approaches and achievement test outcomes (see Appendix C). The instructional variables which were studied thus are probably not major causes of the Indian students' low achievement scores.

4C.4 INSTRUCTIONAL STAFF CHARACTERISTICS

A fourth possible explanation of low achievement test outcomes for Indian students concerns the characteristics of instructional staff. It is possible that the absence (or presence) of Indian staff, the experience of such staff, or the use of aides may be key factors in achievement outcomes.

A number of such factors were studied in regression analyses and other special analyses. In general, instructional staff variables were not reliable predictors of outcomes (they had low simple correlations and highly unstable beta weights in regressions). Although there were a few interesting findings in special analyses (students in some subgroups appeared to do better if they had both Indian and non-Indian teachers), the overall findings provide little explanation for low achievement test outcomes.

4C.5 HOME/FAMILY/COMMUNITY CHARACTERISTICS

A fifth possible explanation of low achievement test scores is the community and family environment in which Indian students live. Such factors as low English language use in the school and community, low parental education levels, and low educational expectations could all be factors in low Indian student achievement.

A number of such factors were examined in the regression and path analyses. The results showed consistent and substantial correlations of achievement test scores with six variables. Test scores were negatively correlated with:

- community use of the Indian language;
- percentage of students speaking the Indian language; and
- use of the Indian language outside of classrooms by principals, teachers, and students.

Test scores were positively correlated with:

- parents' use of English in the home;
- hours per week the child spends reading; and
- parents' expectations of how far the child will go in school.

In regression analyses, the beta weights for these variables tended to be unstable and less substantial. This was due to the fact that many of these predictor variables were intercorrelated (especially those relating to Indian language use). Nonetheless, it appears that lack of exposure to English in the home, school, and community, the lack of reading in the home, and low parental expectations regarding education all may be factors in the low achievement test scores of Indian students. In this regard, it should be noted that parents of Indian students reported less reading by their children and had lower educational expectations than did parents of students in the main LEP study. Indian students had more exposure to English in the home and school, however, than did LM-LEP students in the main study (see Year 1 Report).

4C.6 SUMMARY

The results of our analyses provide some clues concerning the low achievement test scores of Indian students in the study. Community use of Indian languages, and the subsequent low English proficiency of students, do put students in Title VII Indian sites at an educational disadvantage. Lack of exposure to English is not a sufficient explanation, however. Indian students scored lower on Math subtests than did students in the main LEP study, even though their English oral proficiency ratings were higher.

There is also evidence that certain home/family characteristics may be important. Both the amount of reading at home by the students, and parents' expectations for educational level to be achieved, were correlated with achievement test outcomes, and were lower for Indian students than for students in the main LEP study. Lack of home support for educational achievement may thus be an important factor.

On the other hand, the variables related to instruction and instructors which were selected for analysis do not appear to explain the low achievement outcomes. The fact that outcomes (in comparison to norms) were lower in the second year of the study than in the first suggest that there may be problems with the instruction provided. However, identifying the nature of these problems will require either further analysis of the existing data or new research on the instruction of these students. Some thoughts on possible factors are presented in the next section of this chapter.

In summary, two factors (lack of exposure to English and lack of home support for educational achievement) have been implicated in the low achievement test scores of Indian students in the study. Assessing the absolute and relative importance of these and other factors (especially those relating to instruction) will require additional study, however.

4D

D. IMPLICATIONS AND OTHER AVENUES TO EXPLORE

4D.1 UNEXPLORED FACTORS

In the preceding section we examined several variables which might have explained the poor academic achievement of sample students. As noted, only a partial explanation of why the achievement of these students was so low was found. Besides the factors discussed in the preceding section there are a number of others which conceivably were responsible for the poor performance of the students, but which could not be included in the present study; they fall into two categories: (a) factors which are common to all sites and thus could not vary, and (b) sociocultural factors on which it was not within the bounds of the study to collect extensive data. Each of these categories is discussed below.

a. Factors Common to All Sites

There were four variables which were common to all sites but which distinguish the sites from other school systems. These factors may explain low scores, but their influence could only have been studied if comparison schools had been included in this study. Thus, their influence was impossible to determine.

1) Socioeconomic status of the students

This could not be studied because almost all of the sample students came from families with low to very low socioeconomic status.

2) Integration versus segregation

This could not be studied because the student populations at all of the schools included in the study are entirely or almost entirely Indian.

3) Attendance at rural versus suburban versus urban schools

The schools included in the study were all located in extremely remote, rural areas, thus precluding investigation of the effects of this variable on student achievement.

4) Residence on or near a reservation versus residence away from a reservation

   This important variable could not be studied because virtually all of the students included in this study had lived their entire lives on or near a reservation.

On another note, the small size of the student sample also imposed restrictions on the search for explanations for the low achievement of the students. Several potentially interesting analyses of explanatory variables had to be abandoned when the number of available cases became too small.

b. Unexplored Cultural and Sociological Factors

Gilliland (1986, pp. 3-9) points to a number of sociocultural factors as potentially responsible for the poor academic achievement of Indian students. These factors are:

- Cultural differences (i.e., between the student's native culture and the culture of the school);
- Teacher's lack of understanding (i.e., lack of knowledge by instructional staff of the student's native culture);
- Differences in values (i.e., between the student and the teacher);
- Differences in learning styles (i.e., the greater prevalence of "learning by model" versus "learning by rule" among Indian students, the reverse of what normally occurs in school);
- Lack of motivation (i.e., lack of perceived relevance of knowledge obtained in school to life outside the school);
- Differences in background and language (i.e., between the student and the teacher);
- Home and community problems (i.e., problems which the student must deal with at home or in the community); and,
- Use of inappropriate tests (i.e., use of culturally biased tests).

With regard to Gilliland's final point, i.e., the "Use of inappropriate tests," two types of tests were administered to students in this study. They were: (1) a test of academic aptitude (the Raven Progressive Matrices) and (2) a test of academic achievement (selected subtests of the Stanford Achievement Test). The Raven Progressive Matrices is listed by Gilliland (1986, p. 8) as one of four examples of tests which are appropriate for use with Indian students, since it is a non-language test which requires no knowledge of any particular culture.

The question of the "appropriateness" of the subtests of the Stanford Achievement Test is somewhat more complicated to answer. All achievement tests measure cultural knowledge as well as skills knowledge. The "Vocabulary" portions of achievement tests are explicitly and intentionally tests of cultural knowledge since a word is not "known" unless its culturally-based meaning as well as its spelling and pronunciation are known. Similarly, "Reading comprehension" subtests intentionally require a significant amount of cultural comprehension. Furthermore, while mathematics is an abstract, culture-free system, it is relevant in real-life situations only to the extent that it is associated with culture bound behaviors such as buying/selling, banking, cooking, etc. Thus, mathematics tests also test cultural knowledge. It may be questioned whether Indian students living in remote rural areas on or near reservations to know general American culture as reflected in the SAT subtests; however, to the extent that it is a goal of the school to teach general American school subject knowledge — which includes teaching general American culture — the subtests of the Stanford Achievement Test are probably an appropriate measure of the acquisition of this knowledge. Furthermore, all the data we have indicates that teaching general American school subject knowledge is a goal of the schools included in this study and, thus, that the SAT subtests are probably appropriate measures.

Some data relevant to addressing the factors mentioned by Gilliland were gathered during this study. For example, data on student and teacher ethnicity were obtained and could be used to address the issue of "Teacher's lack of understanding," at least in part. (It would also be necessary to know the extent to which teachers not of the same ethnicity as the student had acquired some understanding of the students' culture, a topic on which the study did not obtain sufficient data.) Data were also collected on teacher language background, classroom organization, teacher attitudes towards the use of native language in instruction, use of special instructional materials, and other variables which may be relevant. Thus, further analysis of existing data would appear to be justified.

Differences between the students' native culture and the culture of the schools or their teachers may explain, for example, the Indian students' poor performance in math. Davison and Schindler (1986) in their study of Crow Indian students conclude that three factors adversely influence the students' ability to learn English language mathematics: (1) the role of language; (2) the students' culture; and (3) the students' learning style. With respect to culture and learning style, Davison and Schindler conclude:

> "The influence of the students' culture, and the perceived relevance of the mathematics curriculum, is seen as an additional problem. Except for working with money, students do not perceive the mathematics they learn in school to be of any use to them, nor is the school curriculum seen as culturally relevant. Most significantly, the students did not share either a large number or a wide range of goals. The school curriculum, as far as these students were concerned, related to just one goal -- earning money. Even though these students were young, school had very little meaning for them.
>
> "The methods by which mathematics is typically presented do not consider the Indian student's learning style. Textbooks are typically written for white middle class America and present mathematics as an essentially abstract subject. While many textbook series now make reference to the use of tactile and visual aids, few teachers present mathematics in other than an abstract manner. The Indian student depends upon a more sensory approach to be able to learn mathematics effectively."

However, truly adequate investigation of the factors mentioned by Gilliland and those investigated by Davison and Shindler would require data collection methods which were outside the scope of the study. For example, several would be best addressed by the kind of in-depth, rich data obtainable only through such qualitative data collection methods as observations and ethnographic interviews. Such would be the case, for example, in addressing the topics of "Cultural differences," "Differences in learning styles," and "Home and community problems." Similarly, the investigation of other of these factors would require more extensive parent interviewing than was carried out as well as interviews with study students, something which was not done in this study. This would be the case, for example, for "Differences in values," "Lack of motivation," and "Home and community problems."

4D.2 NEED FOR FURTHER RESEARCH

The most significant finding from the analysis of the data for the second year of this study is that the scores on academic achievement tests of elementary grade-level Indian students attending school on or near Indian reservations are quite low, and that these scores declined or remained the same over the two years of the study. This is true, even though the schools in the study were receiving and had received in the past federal funding targeted at improving student achievement.[1]

Although none of the schools in this study were producing students who were doing well in terms of national norms, there are some schools on or near Indian reservations where this is not the case. There has been much effort and experimentation regarding the education of Indian children over the past 20 years and reputedly there has been some success. It would be appropriate, therefore, to identify systematically those schools which are having verifiable success in terms of achievement test results and, in comparison to schools such as those in this study, to identify factors associated with that success. Based on the results of such a study, recommendations for improvements in the education of Indian children could be drawn.

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[1] All of the schools included in the study receive Title VII (Bilingual Education Act) funds. In addition, most receive ECIA Chapter 1, Title IV (Indian Education Act), Johnson-O'Malley, or other federal funds intended to improve the academic achievement of disadvantaged students.

REFERENCES

Brookover, W.B. & Schneider, J.M. (1975). Academic environments and elementary school achievement. *Journal of Research and Development in Education*, *9*, (1), 82-91.

Brookover, W.B. & Lezotte, L.W. (1979). *Changes in school characteristics coincident with changes in student achievement* (Executive Summary). Occasional Paper No. 17, Michigan State University, Institute for Research on Teaching.

Cervantes, H.T. (1978). *The use of communication skill training and modeling by counselors to enhance reading attitudes of primary age children through the training of their parents*. Unpublished doctoral dissertation, University of Colorado, Boulder, Colorado.

Cervantes, T.H., Baca, L.M. & Torres, D.S. (1979). Community involvement in bilingual education: The bilingual educator as parent trainer. *NABE Journal*, *III*(2), 73-82.

Davison, D.M. & Schindler, D.E. (1986). Mathematics and the Indian Student. IN: Jon Reyhner (Ed.) *Teaching the Indian Child*. Billings, MT: Eastern Montana College.

Dressler, W. & Wodak-Leodolter, R. (Ed.) (1977). *Language Death*. The Hague: Mouton.

Flagg, J.T., Jr. (1965). *The organizational climate of schools: Its relationship to pupil achievement, size of school, and teacher turnover*. (Doctoral dissertation, Rutgers, 1964) *Dissertation Abstracts*, 1965, 26, 818-819.

Gilliland, H. (1986). The need for an adapted curriculum. In: Jon Reyhner (Ed.) *Teaching the Indian child*. Billings, MT: Eastern Montana College.

Gore, J. (1974). *Parental involvement in the Boulder Schools.* Unpublished Masters Report. Boulder, CO: University of Colorado.

Henderson, R.W. (1981). Home environment and intellectual performance. In: R.W. Henderson (Ed.), *Parent-child interaction: Theory, research, and prospects*. New York: Academic Press.

Kennedy, Robert F. (1969). *Indian Education: A National Tragedy - A National Challenge*. Hearings before the Special Subcommittee on Indian Education of the Committee on Labor and Pubic Works, U.S. Senate, Ninetieth Congress. Washington, DC: U.S. Government Printing Office.

Kjolseth, R. (1972). Bilingual education programs in the United States: For assimilation or pluralism. In: B. Spolsky (Ed.), *The language education of minority children*. Rowley, MA: Newbury House Publishers, Inc.

Lambert, W.E. (1977). The effects of bilingualism on the individual: Cognitive and sociocultural consequences. In: P.A. Hornby (Ed.), *Bilingualism: Psychological, social, and educational implications*. New York: Academic Press.

Laosa, L.M. (1982a). Families as facilitators of children's intellectual development at 3 years of age: A causal analysis. In: L.M. Laosa & I.E. Sigel (Eds.), Families as learning environments for children. New York: Plenum Press.

Laosa, L.M. (1982b). School, occupation, culture, and family: The impact of parental schooling on the parent-child relationship. Journal of Educational Psychology, 74(6), 791-827.

McDill, E.L. & Rigsby, L.C. (1973). Structure and process in secondary schools: The academic impact of educational climates. Baltimore, MD: Johns Hopkins University Press.

Meriam, L. (Ed.). (1928 [1971]). The Problem of Indian Administration. Baltimore: John Hopkins Press. [Reprinted, New York: Johnson Reprint Corporation.]

Morocco, J.C. (1978). The relationship between the size of elementary schools and pupils' perceptions of their environment. Education, 1978, 98, 451-454.

National Center for Education Statistics. (1978). The educational disadvantage of language-minority persons in the United States, Spring 1976. Bulletin (78B-4). Washington, DC: U.S. Department of Health, Education, and Welfare.

Raven, J. et al. (1986). Manual for Raven's Progressive Matrices and Vocabulary Scales, Research Supplement No. 3: A Compendium of North American Normative and Validity Studies. London: H.,K. Lewis & Co., Ltd.

Rosenthal, A.S., Baker, K. & Ginsburg, A. (1983). The effect of language background on achievement and learning among elementary school students. Sociology of Education, 56(4), 157-169.

Rudes, B.A., Young, M.A., Shaycoft, M.F., Zehler, A.M., Day, H.R., & Kaplan, L. (1988). Instructional Services for Native American Students with Limited-English-Proficiency. Year one report of the National Evaluation of Services for Limited-English-Proficient Native American Students. Arlington, Virginia: Development Associates.

Young, M.B., Russell, R., Reimer, J., Hopstock, P.J., Goldsamt, M., Fleischman, H., and Rudes, B.A. (1983). The evaluation of the Part A Entitlement Program funded under Title IV of the Indian Education Act. Final Report. Washington, D.C.: Office of Program, Budget, and Evaluation, U.S. Department of Education.

Young, M.B., Hopstock, P.J., Goldsamt, M.R., Rudes, B.A., Bauman, J.E., Fleischman, H.L., Burkheimer, G.J., Zehler, A.M., Ratner, M.S., and Shaycoft, M.F. (1984). Instructing children with limited English ability. Year One Report of the National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students. Washington, D.C.: Office of Program, Budget, and Evaluation, U.S. Department of Education.

Young, M.B., Shaycoft, M.F., Hopstock, P.J., Zehler, A.M., Ratner, M.S., Rivera, C., and Rudes, B.A. (1986). Instructing children with limited English ability. Year One Report of the National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students. Washington, D.C.: Office of Program, Budget, and Evaluation, U.S. Department of Education.

Zehler, A.M. (1985). The validity and reliability of a teacher rating instrument for measuring student oral language proficiency: An examination of the SOLOM. Unpublished manuscript. Arlington, VA: Development Associates, Inc.

Appendix A: GLOSSARY

Part 1. ABBREVIATIONS AND SPECIAL TERMS

Term	Meaning
Academic instruction	Used in discussion of instructional services to refer to math, science, social studies, and ethnic heritage instruction as distinct form instruction in language arts or other subjects.
Adjusted score	A test score corrected for omitted items by adding to the number of items answered correctly a value equal to the quotient obtained when the number of items omitted is divided by the number of options per item.
Algonquian-language students	Students whose native language is an Algonquian language (e.g., Atsina (Gros Ventre), Ojibwa, Passamaquoddy).
Cluster	A set of LEP instructional services received by a student at a given time and defined in terms of the following five characteristics: (1) Percentage of use of the child's native language, in instruction in subjects other than language arts. (2) Whether special instruction in English is provided. (3) Whether simplified English is used more than regular English in instruction in math, science, social studies and ethnic heritage. (4) Whether simplified English is used more than regular English in teaching English language arts. (5) Whether instruction in native language arts is provided. There are 32 clusters.
CPM	Raven Coloured Progressive Matrices (This was the level of the Raven Progressive Matrices Test used in grade 1.)

Term	Meaning
DK	Don't Know (Response to questionnaire item)
English-language students	Students whose native language is English.
EP	English-proficient
ESL	English-as-a-Second Language
Indian	Individuals (singularly or collectively), and their possessions, who are descended from one or another of the indigenous peoples of the Americas, exclusive of Aleuts and Eskimos.
LEP	Limited-English-proficient
LM	Language minority
LM-LEP	Language-minority limited-English-proficient
LM-LEP Study	"National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students"
Major cluster	The six major categories in which the 32 clusters are classified.
Navajo-language students	Students whose native language is Navajo
Other Indian language students	Students whose native language is an Indian language, but not Navajo or an Algonquian or Siouan language.
Raven	Raven Progressive Matrices Test Different levels were used in grades 1 and 3--the CPM level in grade 1 and the SPM level in grade 3.
Rights score	A test score equal to the number of items answered correctly.
SAT	Stanford Achievement Test
S.D.	Standard deviation

Term	Meaning
SEF	Student Evaluation Form This is the form used by teachers to rate students in the study, with respect to their proficiency in various aspects of English, math, and native language.
Services	When this term is used in this report, it refers to instructional services for LEP students.
Service cluster	When this term is used it refers either to the "cluster" as defined above, or to the "major cluster."
SES	Socioeconomic status
Siouan-language students	Students whose native language is a Siouan language (e.g., Assiniboine, Crow, Dakota, Lakota).
SOLOM	Student Oral Language Observation Matrix This is a rating scale, developed under the auspices of the California Department of Education, in which students are rated in five aspects of spoken language: (1) comprehension, (2)fluency, (3) vocabulary, (4) pronunciation, and (5) grammar.
SOPR	Student Oral Proficiency Rating This is a slight modification of the SOLOM, for use in the present study. There are two forms of the SOPR—one for English and one for the student's Indian language. As in the SOLOM, students are rated in five aspects of spoken language: (1) comprehension, (2)fluency, (3) vocabulary, (4) pronunciation, and (5) grammar.
SPM	Raven Standard Progressive Matrices (This was the level of the Raven Progressive Matrices used in grade 3.)

Part 2. STATISTICAL NOTATION

f	Frequency
M	Mean
N	Number of cases
n	Number of items in test
c	Number of choices per multiple-choice item
S.D.	Standard deviation
r_{jk}	Correlation between variables j and k (Unless otherwise specified it is the Pearson product-moment coefficient.)
r_{ii}	Reliability of variable i
$\overline{X}$	Mean of variable X
s	Standard deviation of sample (This is the standard deviation obtained using N as the divisor.)
s_x	Value of s for variable X
σ	Estimate of population standard deviation (This is the standard deviation obtained using N-1, or number of degrees of freedom, as the divisor.)
σ_x	Value of σ for variable X
R^*	*Rights score (i.e., number of test items answered correctly)
O	Number of test items omitted
A	Number of test items attempted
I	Adjusted score (i.e., score adjusted for omitted items)
β	Standard multiple regression weight (beta weight)
R^*	*Multiple correlation coefficient
R'	Multiple correlation coefficient adjusted downward by Wherry skrinkage formula

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*Note the two definitions of R. Context makes it clear which one is appropriate.

Appendix B. STUDY DESIGN AND INSTRUMENTATION[1]

B1 1. INTRODUCTION

The design for this study called for a two-year longitudinal evaluation, modeled after the study design of the "National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students." The first part of the study was focused on describing the services offered to American Indian limited-English-proficient (LEP) students in elementary schools which receive Title VII funding. The second part of the study looked at the academic performance of American Indian LEP students. Title VII projects were selected as the study focus because they would provide an accessible source of Indian LEP students and because there was interest within the Department of Education in a description of Title VII project services for Indian students. The conceptual framework, sampling plan and instrumentation for the first year of the study were described in Appendix C of Rudes et al. (1988). Here we describe the sampling plan and instrumentation for the second year of the study.

B2 2. STUDY DESIGN

B2.a THE SAMPLE

The basic research plan for this study called for two cohorts of students in a national sample of schools served by Title VII-funded projects. The first cohort (Cohort A) consists of students who were in grade 1 during the 1985-86 school year. The second cohort (Cohort B) consists of students who were in grade 3 that year.

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[1] Abbreviations and other special terms used in this study are defined in the glossary in Appendix A.

The sample for the main on-site data collection during the first year of the study consisted of 23 of the 56 funded Title VII projects serving Native American students in the elementary grades during the 1986-87 school year.[1] These 23 projects served a total of 1588 first and third grade Indian students who came from 16 different tribal groups, and who had 18 different native language backgrounds. For the sample for the second year of the study 8 of these 23 projects were selected. The specific projects which participated in the second year of the study are shown in Table B.1. These 8 projects served 278 Cohort A and 210 Cohort B students who, as shown in Table B.2, came from 7 different tribal background and who, as shown in Table B.3, had 7 different native langauges.

B2.b DATA COLLECTION INSTRUMENTS AND INFORMATION SOURCES

At the 23 sites visited during the first year, data were collected regarding school districts, schools, principals, instructional personnel, parents, community leaders, and students. During the second year of the study, data were gathered only from sample students and their teachers.

Much of the data collection during the first year focused on "control variables". The need for control variables in such a study is critical. The term "control variable" as used here refers to a variable that helps prevent distortion of the results that might otherwise occur from different instructional programs as a consequence of different levels of ability and potential among the students in the groups being compared, or other factors extraneous to the focus of the study.

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[1] Note that, because of the high cost of data collection in Alaska, the decision was made by the U.S. Department of Education to exclude projects in Alaska from the main data collection for this study. In addition to the 23 projects included in the main data collection for the first year, data were gathered using case study methodology on two California projects. The findings on these two projects were reported separately, in Appendix A of Rudes et al. (1988).

TABLE B.1. The eight Title VII projects participating in the on-site data collection for Year 2

White Mountain Apache Tribe (White Mountain Apache Reservation, Arizona)
Peach Springs School (Hualapai Reservation, Arizona)
Kaibeto Boarding School (Navajo Reservation, Arizona)
Central Consolidated School District #22 (Shiprock, New Mexico)
Dunseith School District #1 (Dunseith, North Dakota)
Loneman School Corporation (Oglala, South Dakota)
School District 17H (Hardin, Montana)
Mississippi Band of Choctaw Indians (Philadelphia, Mississippi)

TABLE B.2. Number of students in the sample by tribal group

Tribal group	Number of Students
1. Navajo	208
2. Choctaw	60
3. Mitchif (Metis)	59
4. Crow	48
5. Hualapai	47
6. Oglala (Lakota)	34
7. Apache	32
TOTAL	498

TABLE B.3. Number of students in the sample by native language

Language	Number of Students
1. Navajo	174
2. English	99
3. Choctaw	60
4. Crow	47
5. Hualapai	42
6. Lakota	33
7. Apache	32
8. Ojibwa (Chippewa)	1
TOTAL	498

Various different kinds of control variables were deemed desirable. These included a baseline measure of academic ability level independent of the child's language, an evaluation of the child's degree of oral proficiency in English and in the Indian language and measures of achievement in English and mathematics. Also included are measures of home context which prior research suggests may confound the effect of the instructional treatment variables of primary interest. The first of these variables (the baseline measure of academic ability) is provided by the Raven Progressive Matrices, the second by the Student Oral Proficiency Rating (SOPR), and the third by scores on the English and mathematics subtests of standardized achievement tests which the students took last spring. The home context measures are provided by a questionnaire developed specifically for this study. Detailed descriptions of these instruments appear in Appendix C of Rudes et al. (1988).

Other instruments used during the first year were for the purpose of describing the instructional treatments received by each student, the characteristics of the providers of those treatments, or their educational context. Each of these measures was either developed for the "National Longitudinal Evaluation of the Effectiveness of Services for Language-Minority Limited-English-Proficient Students," and modified as appropriate for this study of Native American students, or developed specifically for this study. Again, details of these instruments are provided in Appendix C of Rudes et al. (1988). The specific instruments which were used for data collection during the first year of the longitudinal study are shown in Exhibit B.1.

During the second year of the study, the Student/Teacher Data Form and the Student Instructional Language Record Form were again completed by teachers of sample students to provide the study with current information on the instructional services being received by the students. In addition, the appropriate levels of the Stanford Achievement Test math and English subtests were administered to study students.

EXHIBIT B.1. Study instruments

Instrument	Completed by
Project Director Questionnaire:	Title VII project directors
School Statistical Summary Form:	Development Associates staff from school records and reviewed by school principals
School Principal Questionnaire:	the principal of each school participating in the study
School Policies and Procedures Form:	Development Associates staff
Instructional Staff Questionnaire:	all teachers of content subjects who work with students in the study sample
Support Staff Questionnaire:	all aides, tutors, volunteers, or resource staff who work with students in the study sample
Student/Teacher Data Form:	the homeroom or main teachers of each of the students in the study sample
Student Instructional Language Record:	all teachers of content subjects who work with students in the study sample
Student Performance Record:	the homeroom or main teachers of each of the students in the study sample
Parent/Home Questionnaire:	one parent or guardian for each student in the study sample
Home/Community Language Use Form:	a sample of parents of study students, and a sample of tribal leaders at each site
Student Background Questionnaire:	Development Associates staff members from student records
Student Oral Proficiency Rating Form (English):	the homeroom or main teacher, or another teacher or aide who is fluent in English

EXHIBIT B.1. Study instruments, continued

Instrument	Completed by
Student Oral Proficiency Rating Form (Native American Language):	the homeroom or main teacher, or another teacher or aide who is fluent in the language on which the child is being rated
Academic Aptitude Measure (Raven Progressive Matrices)	
Coloured Progressive Matrices:	each first grade student in the sample
Standard Progressive Matrices:	each third grade student in the sample
Stanford Achievement Subtests Vocabulary Reading Comprehension Concepts of Number Math Computation Math Applications:	all of the students in the study sample.

B3

3. COMPOSITE VARIABLES

Before the data analysis was begun, a number of composite variables were developed, in most cases by combining on an a priori basis selected questionnaire items dealing with the same topic.[1] Formation of many of the composites[2] began at the time the questionnaires and rating scales were being developed. Using a composite of several questionnaire items dealing with the same general area, rather than using the individual items themselves, has at least two advantages. First, the composite (a weighted or unweighted sum of several items) is likely to be more reliable than any of the individual items; and second, using a composite often makes the findings more comprehensible and easier to interpret.

When a composite is to be developed, it is necessary to decide whether it should be done on an a priori basis or empirically. A wide variety of statistical methodologies exist for developing composites empirically (e.g., multiple regression, multiple discriminant analysis, factor analysis), but in a study such as the present one there are sound arguments against each of them. A priori composites have the advantages of greater comprehensibility, convenience, and credibility, and they have an additional advantage in that they make better use of available data, since they do not require a set-aside subsample. Thus, this approach, rather than a more empirically driven one, was adopted for developing most of the composites presented in this report.

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[1] In a few cases the composite was formed by combining ratings on rating scales or scores on tests, rather than responses to questionnaire items.

[2] These composites are generally described briefly at the point in the report where their use in data analysis is reported. Some are described in somewhat more detail in Appendix D of Rudes et al. (1988).

B4 4. SCORING OF TESTS

Because the present study is self-contained, incorporating its own control variables, it is not dependent on published norms in order to evaluate results. This gives us the liberty to modify the scoring procedures used by the test publishers in standardizing their tests where we have reason to believe that the modifications may increase the validity and usefulness of the results. We have taken advantage of this circumstance to make some minor, but we think useful, changes. It should be noted that implementing these changes will not impair the results in any way, since in addition to obtaining scores by the modified procedures we have also obtained the conventional set of rights scores. These latter will serve a useful purpose, in that they will make it possible to use publishers' norms.

B4.a KINDS OF SCORES

Both the Stanford Achievement Test (SAT) and the Raven Progressive Matrices are normally given scores equal to the number of items answered correctly (hereafter referred to as "rights scores"); among items not answered correctly, no distinction is made between omitted items and items answered incorrectly. This mode of scoring a multiple-choice test assumes that every student answers every item. When that assumption does not hold, the child who omits items if he or she is uncertain of the answer is penalized inequitably; the child who makes a guess on all such items will probably get about a third of them right purely by chance if they are three-choice items, a fourth if they are four-choice items, etc., while the child who omits deprives himself of this advantage. One way of handling this problem is to "correct" the rights scores for omitted items by adding to the score the estimated number of items the child would have gotten right by chance had he made a guess rather than omitting the items. We choose to call the score obtained this way the "adjusted score."

In our judgment, using adjusted scores is superior to using rights scores. To express this judgment in somewhat more technical terms, adjusted scores tend to give a more valid indication of the student's level of knowledge or ability than do rights scores. If none of the examinees omits any items, it makes no difference which mode of scoring is used, because the rights score and the adjusted score are exactly equal; but to the extent that children differ in their tendency to omit items when they do not know the answer, it can make a big difference. Because using adjusted scores instead of rights scores has no effect (and therefore can have no ill effect) when no items have been omitted, and because it can represent a major improvement — an increase in fairness — when items have been omitted by some children while other children have answered every item, whether they know the answer or not, we decided to use adjusted scores as the principal scores for both the Stanford Achievement Tests and the Raven. However, as indicated above, we decided to also make a record of the rights scores, to permit comparison with the norms developed by the author or publisher.

As has been implied, rights scores have been used as the basis for norms and other statistics provided by the test publishers or authors. Those who prefer rights scores base their preference on the belief that in scoring tests by hand it is easier to obtain rights scores than adjusted scores, and that on theoretical grounds it does not make much difference which kind of score is used since the correlation between them is typically very high. However, in the present case all scoring is done by computer, and even when the correlation between rights and adjusted scores are very high, there are still likely to be some children who omit large numbers of items, which can substantially distort the results not only for the children affected but for research analyses that include these scores. Thus in subsequent chapters when we report data involving test results, those data, except where indicated to the contrary, will be adjusted score data.

B4.b SETS OF VARIABLES SCORED

There is a slight difference between the list of tests from the Primary 1 SAT battery (used in grade 1) and the Primary 3 battery (used in grade 3). In the latter the following tests are used:

Vocabulary
Reading comprehension
Concept of number
Math computation
Math applications

In the Primary 1 battery, on the other hand, the last two of these five areas are combined in a single test, "Mathematics Computation and Applications." To facilitate comparison of grade 1 and grade 3 results, we have scored the 22 Primary 1 computation and the 23 applications items separately as well as together; and in the Primary 3 battery, we have obtained a combined score for these two tests as well as scoring them separately.

For somewhat similar reasons we have also slightly expanded the set of scores obtained for the Raven. The Raven Standard Progressive Matrices (SPM), which is given in grade 3, consists of five sets of 12 items each — Sets A, B, C, D, E — Set A being the easiest and Set E the most difficult. The Coloured Progressive Matrices (CPM). given in grade 1, consists of three sets of 12 items each — Sets A, AB, and B. Sets A and B are identical to the like-named sets in the SPM except that in the CPM the items are colored. Since the sole function of the coloring is to serve as an attention-grabber for the very small children for whom the CPM is intended, and since the colors provide no clue to the answers, we obtained separate scores for A+B in both CPM and the SPM. The purpose is to facilitate direct comparison between grades 1 and 3 on an identical set of Raven items.

Table B.4 summarizes the scores obtained and other miscellaneous information about the Raven and SAT tests.

TABLE B.4. Miscellaneous information about Raven Progressive Matrices and Stanford Achievement Tests

	Kinds of Score Obtained*	No. of Options Per Item		Number of Items	
Raven Progressive Matrices					
Coloured (CPM)					
Sets A + B	A R I	6		24	
Sets AB	A R I	6		12	
Total (A + AB + B)	R I	-		36	
Standard (SPM)					
Sets A + B	A R I	6		24	
Sets C + D + E	A R I	8		36	
Total (A + B + C + D + E)	R I	-		60	
		Primary		Primary	Primary
		Level → 1	3	1	3
Stanford Achievement Test					
English					
Vocabulary	A R I	3	4	38	38
Reading Comprehension	A R I	3	4	40	60
Total	I	-	-	78	98
Math					
Concepts of Number	A R I	4	4	34	34
Computation	A R I	4	5	22	42
Applications	A R I	4	5	23	38
Computation + Applications	R I	-	-	45	80
Total	R I	-	-	79	114
Total (English + Math)	I	-	-	157	212

*Code for "kind of score"
A = No. of items attempted
R = No. of items right
I = adjusted score

Appendix C. THE SEARCH FOR CAUSALITY: METHODOLOGY AND DATA

C.1 1. INTRODUCTION

This appendix focuses on efforts to determine the extent to which various factors are related to achievement in three areas (English language vocabulary, reading in English, and mathematics) and to draw inferences as to which of these relationships, if any, may be "causative." We have put the word "causative" in quotation marks because, as is agreed by many statisticians, the question of what causes what is such a complex one that in most circumstances causation is virtually impossible to determine definitively. Nevertheless we have brought to bear a broad array of statisticians' tools — crosstabulations, breakdowns of means and standard deviations by subgroup, correlations, multiple regression, analysis of variance, analysis of covariance, and path analysis - in an effort to at least throw some light on the question, with respect to Indian schoolchildren. The factors investigated, as probably (or at least possibly) having some relationship to student achievement, fall in the following seven categories:

1. Initial status of students ("control variables")
2. Instructional variables
3. Previous scores on achievement tests
   Note that this category logically belongs with category 1; however it was found more convenient to treat it separately.
4. School variables
5. Teacher variables
6. Home-and-family variables
7. Preschool

The variables in each category are described in Chapter 4 Section B, together with, a similarly brief description about each of the achievement measures.

C.2 2. ANALYSIS OF THE DATA

C.2a REGRESSION ANALYSIS

As a start in investigating the role of the student's initial status and the instruction received, correlation matrices were run and used as the basis of multiple regression analyses against the three criterion variables - Vocabulary, Reading Comprehension, and Math Total. This was done separately for two sets of independent variables - "Set I," consisting of the first three of the seven categories above, and "Set II," consisting of categories 4-7. For the Set I variables, 12 separate multiple regression analyses were run (3 criterion variables x 2 cohorts x 2 years). For Set II it was only necessary to run 6 analyses; this was because the independent variables in this set (essentially school, teacher, and family variables) either were stable enough that data on them only had to be collected once or else, if they were likely to differ from year to year, they were averaged over the two years. Therefore the year 2 criterion measures were the only ones needed for this set of multiple regressions.

Table C.1a shows the Set I regression analysis results for two independent variables - SAT Vocabulary and SAT Reading Comprehension - and Table C.1b shows the corresponding results for SAT Math. As shown in the two tables, the 12 multiple correlation coefficients range from a low of .50 to a high of .83. When adjusted* downward to make the multiple correlations comparable to each other even when based on different numbers of cases and different numbers of independent variables, the reductions turn out to be quite small (.01 to .04) and the corrected values still quite large (.46 to.81). Inspection of the two tables reveals that the largest Year 1 standardized regression weight (beta weight) in almost every analyses is for English SOPR. For the Math criterion, the Year 1 Raven betas are also quite substantial, particularly for grade 3. In most cases the Indian SOPR has a negative

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*Adjusted by the Wherry shrinkage formula, which corrects for the effect of number of independent variables and number of cases. (The resulting reduction in the multiple R is greatest when the number of cases is small and the number of variables large.)

TABLE C.1a Multiple regression analysis for predicting SAT Vocabulary and SAT Vocabulary Comprehension from instructional and other variables

Note: Each of the 8 multiple regression analyses is based on listwise data.

Row #	Dependent Variable	Independent Variables	BETA WEIGHTS AND CORRELATIONS WITH INDEPENDENT VARIABLES							
			COHORT A				COHORT B			
			Year 1 Grade 1		Year 2 Grade 2		Year 1 Grade 3		Year 2 Grade 4	
			β	r	β	r	β	r	β	r
	SAT Vocab	"Control variables"								
1		Raven	.05	.15	.04	.13	.18	.27	.10	.27
2		English SOPR	.51	.60	.03	.46	.35	.42	.09	.40
3		Indian SOPR	-.05	-.25	-.08	-.25	-.22	-.24	-.13	-.20
		English instruction Hrs/wk								
		English (Reg. + Spec.)								
4a		Year 1	-.08	-.21	—	—	.05	-.06	—	—
4b		Year 2	—	—	.06	.04	—	—	.11	.00
		Special English								
5a		Year 1	-.18	-.34	—	—	-.03	-.10	—	—
5b		Year 2	—	—	-.05	-.17	—	—	-.07	.14
		Math, sci., and soc. studies instruction								
		% in Indian language								
6a		Year 1	-.09	-.28	—	—	-.04	-.11	—	—
6b		Year 2	—	—	-.04	-.26	—	—	.20	.03
		SAT Year 1								
7		Vocabulary	—	—	.49	.67	—	—	.51	.64
8		Rdg. Comp.	—	—	.18	.53	—	—	.19	.53
		Multiple R		.65		.69		.50		.72
		R' (Adjusted multiple R)*		.64		.67		.46		.69
		n**	6		8		6		8	
		N**	233		183		132		124	
	SAT	"Control variables"								
1	Reading	Raven	.07	.18	.08	.23	.24	.38	.12	.42
2	Comp.	English SOPR	.45	.49	.13	.49	.48	.56	.07	.47
3		Indian SOPR	.15	-.03	-.03	-.14	-.01	-.05	-.03	-.03
		Instruction variables								
		English instruction								
4a		Hrs/wk. Year 1	-.05	-.15	—	—	-.01	-.15	—	—
4b		Hrs/wk. Year 2	—	—	.04	.10	—	—	-.01	-.11
		Math instruction								
5a		Hrs/wk.								
5b		Year 1	-.17	-.29	—	—	-.03	-.16	—	—
		Year 2	—	—	-.09	-.27	—	—	-.03	.02
		% in Indian lang.								
6a		Year 1	-.12	-.23	—	—	-.06	-.14	—	—
6b		Year 2	—	—	-.02	-.30	—	—	.04	.01
		SAT Year 1								
7		Vocabulary	—	—	.04	.56	—	—	.07	.48
8		Rdg. Comp.	—	—	.63	.77	—	—	.67	.79
		Multiple R		.56		.79		.60		.81
		R' (Adjusted multiple R)*		.55		.78		.58		.79
		n**	6		8		6		8	
		N**	233		183		150		124	

* Corrected by Wharry shrinkage formula: $R' = \sqrt{1 - (1-R^2) \cdot \frac{N-1}{N-n-1}}$

** Notation
n = no. of independent variables
N = no. of cases

TABLE C.1b Multiple regression analyses for predicting SAT Math Total from instructional and other variables

Note: Each of the 4 multiple regression analyses is based on listwise data.

Row #	Independent Variables	BETA WEIGHTS AND CORRELATIONS WITH INDEPENDENT VARIABLES							
		COHORT A				COHORT B			
		Year 1 Grade 1		Year 2 Grade 2		Year 1 Grade 3		Year 2 Grade 4	
		β	r	β	r	β	r	β	r
	"Control variables"								
1	Raven	.27	.37	.09	.30	.43	.53	.11	.52
2	English SOPR	.50	.56	.09	.45	.39	.49	.08	.46
3	Indian SOPR	.07	-.05	.13	-.02	-.02	-.01	-.14	-.08
	Instructional variables								
	English instruction								
4a	Hrs./wk: yr. 1	-.12	-.23	—	—	-.02	-.13	—	—
4b	Hrs./wk: yr. 2	—	—	.04	.00	—	—	-.11	-.08
	Math instruction								
	Hrs./wk.								
5a	Yr. 1	.00	-.04	—	—	.09	-.04	—	—
5b	Yr. 2	—	—	-.04	.09	—	—	.16	.05
	% in Indian language								
6a	Year 1	.01	-.12	—	—	.04	-.08	—	—
6b	Year 2	—	—	-.13	-.15	—	—	.04	-.04
	SAT Year 1								
7	Vocabulary	—	—	.12	.51	—	—	-.18	.35
8	Reading Comp.	—	—	.04	.51	—	—	.33	.68
9	Math Total	—	—	.55	.69	—	—	.54	.75
	Multiple R		.64		.73		.64		.83
	R (Adjusted multiple R)*		.62		.71		.62		.81
	n**	6		9		6		9	
	N**	219		168		145		99	

* Corrected by Wherry shrinkage formula: $R' = \sqrt{1 - (1-R^2) \cdot \frac{N-1}{N-n-1}}$

** Notation
n = no. of independent variables
N = no. of cases

regression weight (as well invariably having a negative correlation with the criterion variable). The chief exceptions are that the regression weight is +.13 for grade 2 Math, and +.15 for grade 1 Reading Comprehension.

A large part of the difference between Year 1 and Year 2 results is undoubtedly due to the inclusion of the SAT Year 1 scores as independent variables in the Year 2 analyses. In these analyses the SAT variable corresponding to the criterion variable has a high beta weight in each regression analysis.

Between them, the "control variables" and the SAT Year 1 scores seem to account for almost all of the criterion variance that can be predicted by Set I variables. That leaves little or nothing for the instructional variables. Thus both the amount of instruction provided and how that instruction is divided between presentation in English and in an Indian language tend, in most cases, to have only a negligible beta weight.

Using as the basis adjusted multiple correlation coefficients obtained as successive variables or subsets of variables are added, the corresponding incremental change in percentage of criterion variance accounted for has been computed. These percentages are shown in Table C.2, in the columns headed by "$\triangle$". Each successive value of $\triangle$ represents the percentage of total criterion variance accounted for by the indicated independent variable or subset of variables after all the preceding variables have been taken into account. Thus, for instance, in grade 3 that part of Indian SOPR that is independent of Raven and English SOPR accounts for 4.5 percent of the Vocabulary variance. This table shows clearly the preponderant effect of English SOPR, and in the case of Year 2 data the Year 1 SAT scores, on the Vocabulary and Reading Comprehension criteria. Raven also has a substantial effect in some cases, particularly in Cohort B. As for the Math criterion, the Raven plays a much more important role than for either of the other two criteria; in the case of the Cohort B data it accounts for over one-fourth of the Math variance.

Table C.2 Adjusted multiple correlation coefficients and percentage of dependent variable variance explained by them, when various subsets of independent variables are included

NOTE: This table is based on the same data as Tables C.1a and C.1b.

NOTATION

n = number of independent variables on which R' is based.
R' = adjusted multiple correlation coefficient (adjusted using Wherry shrinkage formula; see footnote in Table C.1a).
$100(R')^2$ = percentage of variance accounted for by R'.
Δ = incremental change in percentage of variance accounted for.

Cohort	Year	Grade	INDEPENDENT VARIABLES	SAT Vocabulary				SAT Reading Comp.				SAT Math Total			
				n	$100(R')^2$	Δ	R'	n	$100(R')^2$	Δ	R'	n	$100(R')^2$	Δ	R'
A	1	1	Raven	1	2.0	2.0	.140	1	2.7	2.7	.165	1	13.3	13.3	.365
			+ English SOPR	2	35.9	33.9	.599	2	24.7	22.0	.497	2	38.2	24.9	.618
			+ Indian SOPR	3	36.2	.3	.602	3	25.6	.9	.506	3	38.2	.0	.618
			+ Year 1 instructional variables	6	41.4	5.2	.643	6	30.0	4.4	.548	6	38.7	.5	.622
A	2	2	Raven	1	1.2	1.2	.109	1	4.8	4.8	.218	1	8.7	8.7	.294
			+ English SOPR	2	21.2	20.0	.460	2	26.8	22.0	.518	2	26.2	17.5	.512
			+ Indian SOPR	3	22.4	1.2	.474	3	26.5	-.3	.514	3	26.5	.3	.515
			+ Year 2 instructional variables	6	24.6	2.2	.496	6	31.9	5.4	.565	6	25.9	-.6	.509
			+ Year 1 SAT	8	45.5	20.9	.674	8	61.4	29.5	.783	9	51.0	25.1	.714
B	1	3	Raven	1	6.6	6.6	.257	1	14.0	14.0	.374	1	27.5	27.5	.524
			+ English SOPR	2	18.6	12.0	.431	2	35.4	21.4	.595	2	39.3	11.8	.627
			+ Indian SOPR	3	23.1	4.5	.480	3	35.0	-.4	.592	3	38.9	-.4	.624
			+ Year 1 instructional variables	6	21.5	-1.6	.464	6	33.9	-1.1	.582	6	38.5	-.4	.620
B	2	4	Raven	1	6.5	6.5	.255	1	17.1	17.1	.414	1	26.3	26.3	.513
			+ English SOPR	2	17.7	11.2	.420	2	31.0	13.9	.557	2	37.0	10.7	.609
			+ Indian SOPR	3	20.9	3.2	.457	3	30.6	-.4	.553	3	37.3	.3	.610
			+ Year 2 instructional variables	6	20.7	-.2	.455	6	32.1	1.5	.567	6	38.4	1.1	.619
			+ Year 1 SAT	8	47.9	27.2	.692	8	62.4	30.3	.790	9	65.5	27.1	.809

The results of the six multiple regression analyses involving the Set II independent variables (home, school, teacher, etc.) are shown in Table C.3. It must be recognized of course, that there is undoubtedly some correlational overlap between the two sets of variables. Each of the six analyses had 21 independent variables: 3 school variables, 7 teacher variables, one preschool experience variable, and 10 home-and-family variables. As shown in Table C.3, the adjusted multiple correlation coefficients for these data are much smaller than the raw values. This is to be expected when, as in the present situation, the number of cases is relatively small, and the number of independent variables large in relation to the number of cases. There is no analogous correction formula available for the regression weights, although they, too, are affected; therefore they should not be taken at face value.

As seen in Table C.3, only about six of the variables have fairly substantial correlations with the criteria. For three of the six variables, the correlations are negative; for the remaining three, positive - as follows:

- Variables negatively correlated with criteria:
    - Percentage of students speaking an Indian language (Row 2 of table)
    - Extent of Indian language use (by students, teachers, and principal) in and around the school (Row 3)
    - Whether the classroom teacher (as opposed to aides) provides all the non-language-arts instruction
- Variables positively correlated with criteria:
    - Parents' use of English in the home (Row 13)
    - Hours per week the child spends reading, apart from homework assignments (Row 16)
    - Parental expectations regarding how far the child will go in school (Row 21)

Most of these variables, however, do not have substantial beta weights - or if they do, the beta weights are not all in the same direction. The principal exception is for the Row 2 variable (percentage of students speaking an Indian language), for which most of the beta weights are substantial, and all six are

Table C.3 Multiple regression analyses for predicting Year 2 SAT scores from various school, teacher, and family variables

Note: Each of the 8 multiple regression analyses is based on listwise data.

Row #	VARIABLE	BETA WEIGHTS AND CORRELATIONS WITH INDEPENDENT VARIABLES											
		SAT (Form E) Vocabulary				SAT (Form E) Reading Comp.				SAT (Form E) Math Total			
		Cohort A Grade 2		Cohort B Grade 4		Cohort A Grade 2		Cohort B Grade 4		Cohort A Grade 2		Cohort B Grade 4	
		β	r	β	r	β	r	β	r	β	r	β	r
	School variables												
1	% LEP in grades K-6	.72	-.06	.32	-.12	.72	-.19	-.52	-.04	.91	-.08	.01	-.14
2	% of students speaking an Indian language	-.36	-.39	-.29	-.51	-.24	-.33	-.17	-.39	-.64	-.24	-.42	.50
3	Indian language use outside of class	.01	-.25	-.15	-.48	-.05	-.11	-.70	-.43	.28	-.06	-.72	-.59
	Teacher variables												
4	May use Indian language with students, outside class***(M**) } Ques.28	.35	.27	.55	.06	.29	.10	.42	.04	.79	.23	-.06	.12
5	May use Indian language with students, outside class***(A**) } Ques.28	.08	.20	-.31	.00	-.37	-.01	-.18	-.01	-.64	.13	.23	.04
6	Considers self a Native American***(M**) } Ques.10a	.09	.22	-.68	.08	.56	.18	-1.16	-.02	.39	.28	-.52	.11
7	Considers self a Native American***(A**) } Ques.10a	-.54	.11	.82	.07	-.46	-.10	.76	.00	-.92	-.03	.32	.11
8	Years teaching experience (M**)	-.19	-.19	.27	.18	-.23	-.18	.08	.17	-.16	-.21	.14	.09
9	Classroom teacher provides all MSS instruction(1) vs. other, e.g. aide (0) (M**)	-.05	-.28	-.16	-.29	-.15	-.14	.16	-.16	-.09	-.19	.28	-.18
10	Is(1) or is not (0) an aide (A**)	-.29	-.04	-.55	.00	-.65	-.22	.13	.05	.02	-.07	-.10	.02
	Preschool experience												
11	Did child attend preschool?***	-.05	-.10	.00	-.28	.13	.18	.04	-.16	.13	.17	.21	-.16
	Home and family variables												
12	Parents' education - Composite B	-.03	.00	.08	.21	.01	-.03	.06	.11	.03	.01	.12	.10
13	Parents' use of English in the home - Composite A	.07	.25	.34	.61	-.17	.00	-.25	.32	-.15	.01	-.22	.40
14	English newspapers or magazines in the home	-.03	.10	.09	.23	.01	.10	-.08	.01	.03	.13	-.08	-.01
15	Hours/week spent: Being read to	.06	.11	-.12	.01	-.04	.12	-.24	.07	-.04	.08	.03	.17
16	Hours/week spent: Reading	-.08	.13	.00	.23	.18	.23	.27	.37	.19	.21	.25	.33
17	Hours/week spent: TV/radio programs in English	.17	.26	-.11	.06	-.06	.23	-.11	.06	.02	.18	-.16	.07
18	Hours/week spent: Homework	-.09	-.08	.23	.07	.02	.06	.13	.10	-.13	-.03	-.07	-.11
19	Parent's view of importance of school	-.02	.02	-.01	.12	-.05	-.10	.02	.15	-.06	-.12	-.16	.11
20	Parent's interest in child's education	-.07	.00	.01	.07	.07	.08	.07	.06	.12	.12	-.02	.03
21	Parental expectations	.12	.28	.09	.20	.09	.25	.28	.28	.06	.22	.20	.17
	Multiple R		.58		.76		.64		.72		.67		.75
	R² (Adjusted multiple R)*		.34		.64		.46		.57		.51		.46
	n**	21		21		21		21		21		21	
	N**	85		72		85		71		84		49	

*Corrected by Wherry shrinkage formula. (See Table C.1a footnote, for formula.)

**Notation

n = no. of independent variables
N = no. of cases
M = average of main teachers' responses
A.= aggregation of all teachers - main and other
MSS = math, science, and social studies

negative. The Row 1 variable (percentage of LEP students in grades K-6) has by far the numerically highest beta weight in most of the six regression analyses, but one of these high weights is negative (and one weight is essentially zero). Other oddities are that the Row 4 and Row 5 variables, which are essentially the same variable except that one is for the main teacher and the other is for aggregated teachers, tend to have betas with opposite signs (and in some analyses these contradictory betas are numerically very large). The same phenomenon also occurs for another pair of variables (the Row 6 Row 7 pair). All these peculiarities are probably explained by the "bouncing beta" phenomenon - the tendency for beta coefficients to be very unstable when intercorrelations among the affected variables are high, particularly when the number of cases is not large. In view of all this instability we recommend not paying too much attention to the beta weights. (The correlations coefficients are much more stable and in a certain sense more informative; like the beta weights they are shown in Table C.3.)

Nevertheless, in spite of the questionable nature of some of the beta weights, it seemed advisable to check further on two of the variables for which these weights were substantial - the Row 4 variable (Teacher Questionnaire item 28a) and the Row 6 variable (Teacher Questionnaire item 10a) - to determine whether analyses of variance with two independent variables (the questionnaire item response of the child's teacher and the child's Raven score) would reveal existence of a real relationship (e.g., a significant effect for the questionnaire item). Table C.4a shows the results for question 10a and Table C.4b shows corresponding data for question 28a. (The exact wording of the questions is shown at the top of the tables.) The main effect for question 10a was significant for two of the six analyses of variance (two cohorts, three criterion variables); for question 28a none of the six was significant.*

Because of the mildly encouraging results for question 10a we went one step further for the two sets of data for which the main effect was significant, by obtaining means and standard deviations on the dependent variable for each of

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*The .05 level of significance was used as the cutting point.

TABLE C.4a Two-way analysis of variance of students' year 2 scores on SAT Vocabulary Reading Comprehension, and Math Total, with Raven total and responses of main teachers to question 10a as the independent variables

Question 10.(a) Do you consider yourself to be a member of a Native American group?

No...................... 1
Yes..................... 2

Cohort	Grade	Sources of Variance ↓	Dependent Variables → SAT Vocab. F	df	p	SAT Rdg. Comp. F	df	p	SAT Math Total F	df	p
A	2	Main effects									
		Raven	8.94	1	.00	17.02	1	.00	29.22	1	.00
		Question 10a (3 levels)	1.64	2	.20	5.36	2	.00	3.65	2	.03
		Interaction	3.31	2	.04	.26	2	.77	8.20	2	.00
		Residual variance		238			237			222	
		TOTAL		243			242			227	
B	4	Main effects									
		Raven	7.06	1	.01	18.76	1	.00	23.30	1	.00
		Question 10a (3 levels)	1.01	2	.36	1.02	2	.36	1.32	2	.27
		Interaction	2.55	2	.08	2.45	2	.09	2.04	2	.13
		Residual variance		180			181			158	
		TOTAL		185			186			163	
No. of cases											
		Cohort A		244			243			228	
		Cohort B		186			187			164	

TABLE C.4b Two-way analysis of variance of students' year 2 scores on SAT Vocabulary Reading Comprehension, and Math Total, with Raven total and responses of main teachers to question 28a as the independent variables

Question 28.(a) When you interact with your Native American LEP students outside of the classroom (in hallways, lunch rooms, after-school activities or other informal contacts), do you ever use a language other than English?

No...................... 1
Yes..................... 2

Cohort	Grade	Sources of Variance ↓	Dependent Variables → SAT Vocab. F	df	p	SAT Rdg. Comp. F	df	p	SAT Math Total F	df	p
A	2	Main effects									
		Raven	8.53	1	.00	16.07	1	.00	28.01	1	.00
		Question 28a (3 levels)	1.24	2	.29	1.50	2	.22	1.77	2	.17
		Interaction	1.22	2	.30	2.98	2	.05	2.60	2	.08
		Residual variance		238			237			222	
		TOTAL		243			242			227	
B	4	Main effects									
		Raven	6.95	1	.01	19.64	1	.00	23.90	1	.00
		Question 28a (3 levels)	.80	2	.45	.21	2	.81	1.33	2	.27
		Interaction	1.94	2	.15	6.30	2	.00	3.23	2	.04
		Residual variance		180			181			158	
		TOTAL		185			186			163	
No. of cases											
		Cohort A		244			243			228	
		Cohort B		186			187			164	

TABLE C.5 Means and standard deviations of Cohort A students' year 2 scores on SAT Reading Comprehension, and SAT Math Total for students classified on the basis of Raven total and main teachers ethnicity (their response to question 10a).

Question 10.(a) Do you consider yourself to be a member of a Native American group?

No.................... 1
Yes.................... 2

Ethnicity of the child's main teachers during the two-year period		SAT Reading Comprehension		SAT Math Total	
		Raven 0 - 20	Raven 21 - 36	Raven 0 - 20	Raven 21 - 36
Both (or all) consider selves non-Indian	M	16.21	21.00	45.65	63.21
	σ	6.50	8.30	13.69	17.83
	N	67	72	66	67
At least one Indian, and at least one non-Indian	M	21.00	24.31	59.57	58.81
	σ	8.07	7.55	14.56	13.09
	N	35	32	30	31
Both (or all) consider selves Indian	M	17.18	20.50	48.06	53.67
	σ	8.32	9.83	14.01	14.96
	N	17	20	16	18
TOTAL	M	17.76	21.77	49.72	60.55
	σ	7.51	8.45	15.10	16.51
	N	119	124	112	116

three mean response levels on the questionnaire item. The results (shown in Table C.5) indicate that the relationship is not unidirectional. The means are markedly higher for children who had had at least one Indian teacher and one non-Indian teacher than for children all of whose teachers, or none of whose teachers, were Indian. The explanation for these findings is not evident. But it may be relevant that the significant effects occur only for Reading Comprehension and Mathematics - two subjects in which the teacher plays a major role in transmitting skills - as opposed to the kind of vocabulary measured by the SAT Vocabulary test, which in normal circumstances is learned primarily outside of school.

C.2b PATH ANALYSIS

Path analysis, which is an elaboration of multiple regression, was the next step in the analyses. Separate path models were developed for Year 2 adjusted scores on the Vocabulary, Reading Comprehension, and Mathematics Total portions of the Stanford Achievement Test. Theoretical models were developed and were tested using procedures suggested in a paper by the United States General Accounting Office (1982).* This approach uses regression results from all intermediate variables and from the final outcome variable, and uses standardized regression coefficients for unidirectional path coefficients and simple bivariate correlations for bidirectional path coefficients.

The variables used in the path models were:

- Community Language Use;
- Raven: adjusted total score;
- Hours English Instruction (Year 1);
- Percentage Indian Language Use in Math, Science, Social Studies, and Ethnic Heritage [or Math only] (Year 1);
- SAT [Vocabulary, Reading Comprehension, or Math Total] (Year 1): relevant adjusted score on the Standard Achievement Test in Year 1;

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*U.S. General Accounting Office, Institute for Program Evaluation. "Methodology Transfer Paper 1. Causal Analysis: A Method to Identify and Test Cause and Effect Relationships in Program Evaluations." Washington, D.C.: February 1982.

- SOPR English: total score;
- SOPR Indian Language: total score;
- Hours English Instruction (Year 2);
- Percentage Indian Language Use in Math, Science, Social Studies, and Ethnic Heritage [or Math only] (Year 2); and
- SAT [Vocabulary, Reading Comprehension, Math Total] (Year 2): relevant adjusted scores on the Stanford Achievement Test in Year 2.

These variables are described in Chapter 4, Section B.

The results of the path model analyses are shown in Figures C.1 to C.6. The path analyses do not greatly expand the insights from the multiple regression analyses described in the preceding section. The path analyses do suggest that:

- treatment variables (hours of instruction, percentage Indian language use) are relatively weak preductors of Stanford Achievement Test outcomes;
- Raven scores are somewhat stronger predictors for the third-grade cohort than the first-grade cohort;
- the strongest predictors of SAT test scores are other test scores or ratings (previous SAT tests, Raven tests, oral proficiency ratings).

In addition to the above findings concerning the direct prediction of achievement test outcomes, there are two findings which are related to non-criterion variables:

- community language use is more strongly correlated with Indian language oral proficiency than with English oral proficiency (indicating that Indian language proficiency is less variable within sites than is English proficiency); and
- treatment variables are moderately predicted by community languages use.

C.2c COVARIANCE ANALYSIS

Since analysis of variance (or covariance) may show significant effects where multiple regression and its variant, path analysis, do not, the next step was to run analyses of covariance, in an effort to determine whether the language of instruction really had as little effect as the multiple regression

Figure C.1 Model for Reading Comprehension/Cohort A/(n=182)

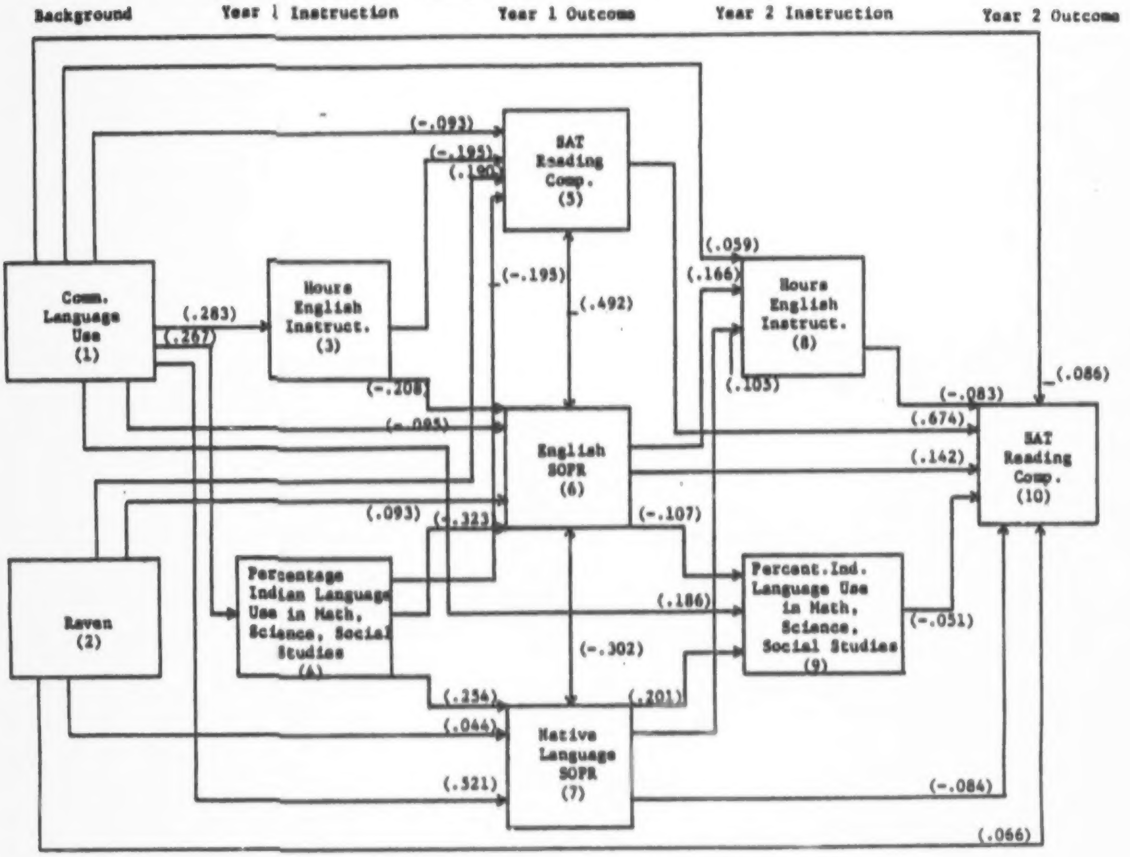

Background
Year 1 Instruction
Year 1 Outcome
Year 2 Instruction
Year 2 Outcome
Comm. Language Use (1)
Raven (2)
Hours English Instruct. (3)
Percentage Indian Language Use in Math, Science, Social Studies (4)
SAT Reading Comp. (5)
English SOPR (6)
Native Language SOPR (7)
Hours English Instruct. (8)
Percent.Ind. Language Use in Math, Science, Social Studies (9)
SAT Reading Comp. (10)
(-.093)
(-.195)
(.190)
(.283)
(.267)
(-.195)
(.492)
(.059)
(.166)
(.105)
(-.208)
(-.095)
(.093)
(-.323)
(-.107)
(.186)
(-.302)
(.254)
(.201)
(.044)
(.521)
(-.083)
(.086)
(.674)
(.142)
(-.051)
(-.084)
(.066)

Figure C.2 Model for Reading Comprehension/Cohort B/(n=140)

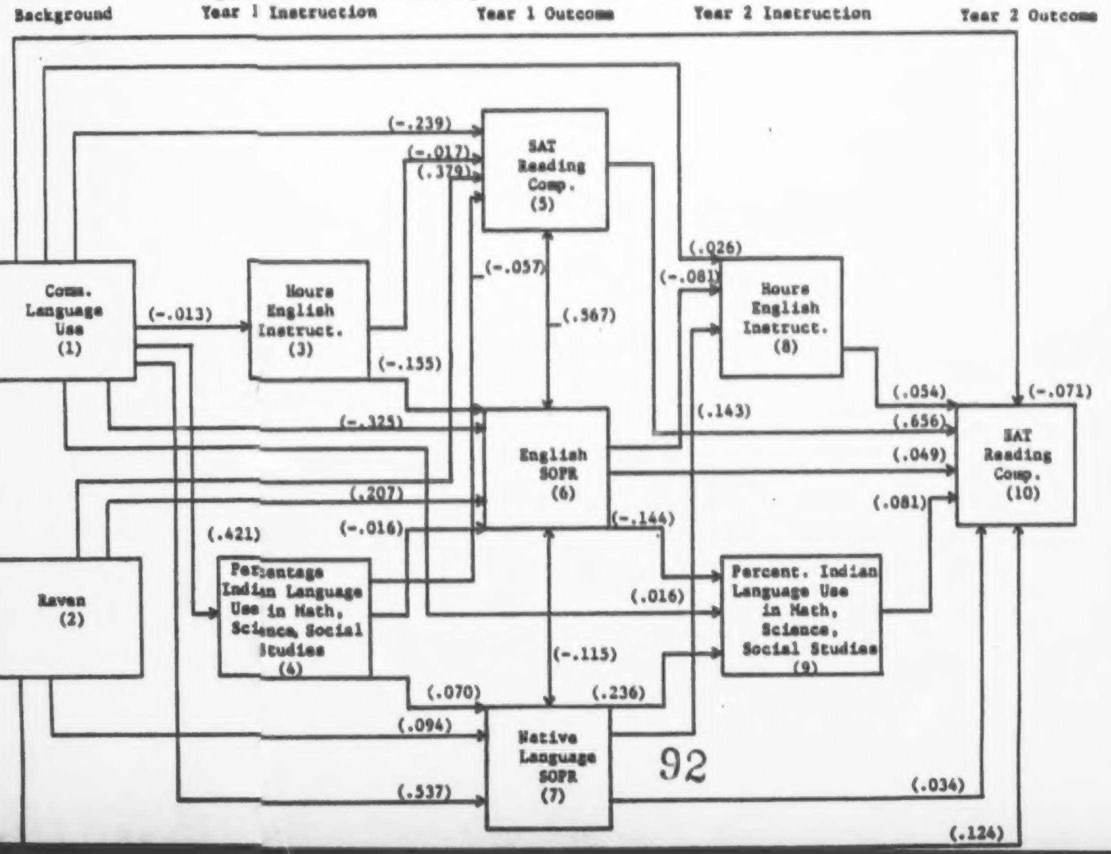

Background
Year 1 Instruction
Year 1 Outcome
Year 2 Instruction
Year 2 Outcome
Comm. Language Use (1)
Raven (2)
Hours English Instruct. (3)
Percentage Indian Language Use in Math, Science, Social Studies (4)
SAT Reading Comp. (5)
English SOPR (6)
Native Language SOPR (7)
Hours English Instruct. (8)
Percent. Indian Language Use in Math, Science, Social Studies (9)
SAT Reading Comp. (10)
(-.239)
(-.017)
(.379)
(-.013)
(-.057)
(.567)
(.026)
(-.081)
(-.155)
(.143)
(-.325)
(.207)
(.421)
(-.016)
(-.144)
(.016)
(-.115)
(.070)
(.236)
(.094)
(.537)
(.054)
(-.071)
(.656)
(.049)
(.081)
(.034)
(.124)

Figure C.3 Model for Vocabulary/Cohort A/(n=182)

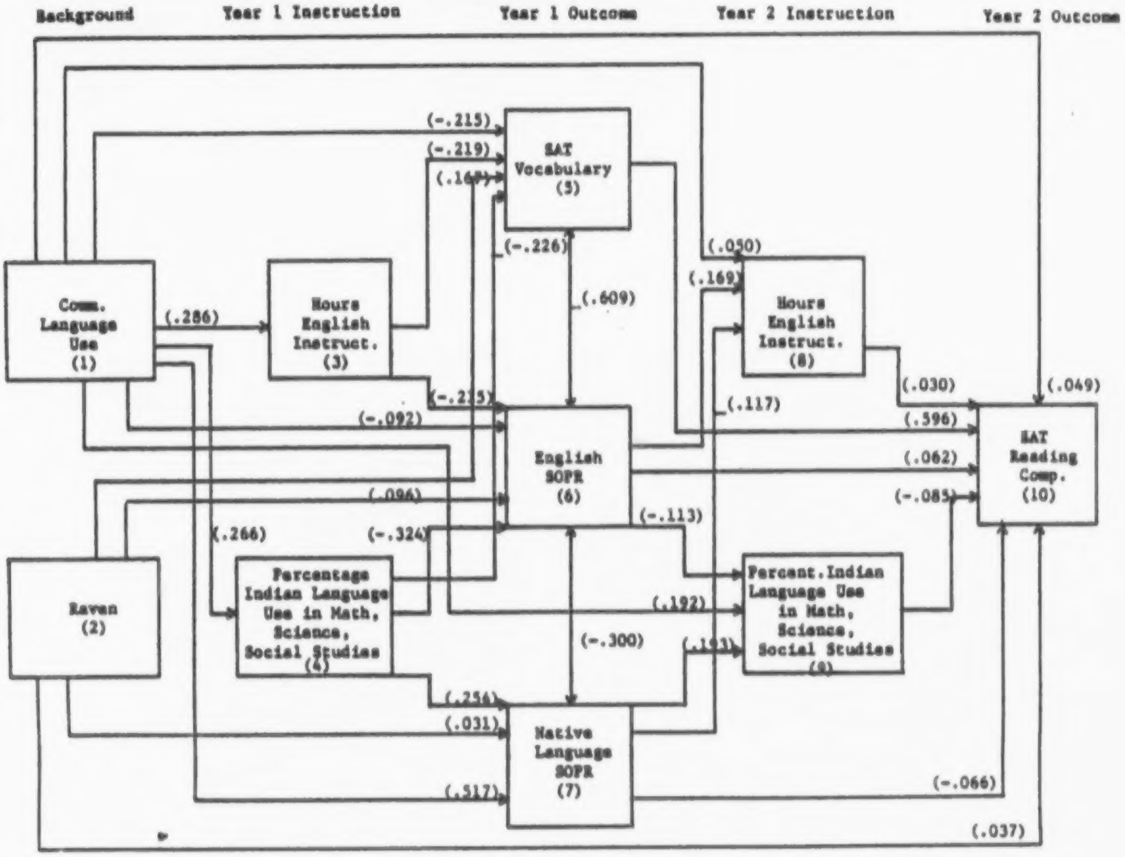

Background
Year 1 Instruction
Year 1 Outcome
Year 2 Instruction
Year 2 Outcome
Comm. Language Use (1)
Raven (2)
Hours English Instruct. (3)
Percentage Indian Language Use in Math, Science, Social Studies (4)
SAT Vocabulary (5)
English SOPR (6)
Native Language SOPR (7)
Hours English Instruct. (8)
Percent. Indian Language Use in Math, Science, Social Studies (9)
SAT Reading Comp. (10)
(.286)
(-.215)
(-.219)
(.169)
(-.226)
(.609)
(-.215)
(-.092)
(.096)
(.266)
(-.324)
(.256)
(.031)
(.517)
(-.300)
(.050)
(.169)
(.117)
(-.113)
(.192)
(.193)
(.030)
(.049)
(.596)
(.062)
(-.085)
(-.066)
(.037)

Figure C.4 Model for Vocabulary/Cohort B/(n=122)

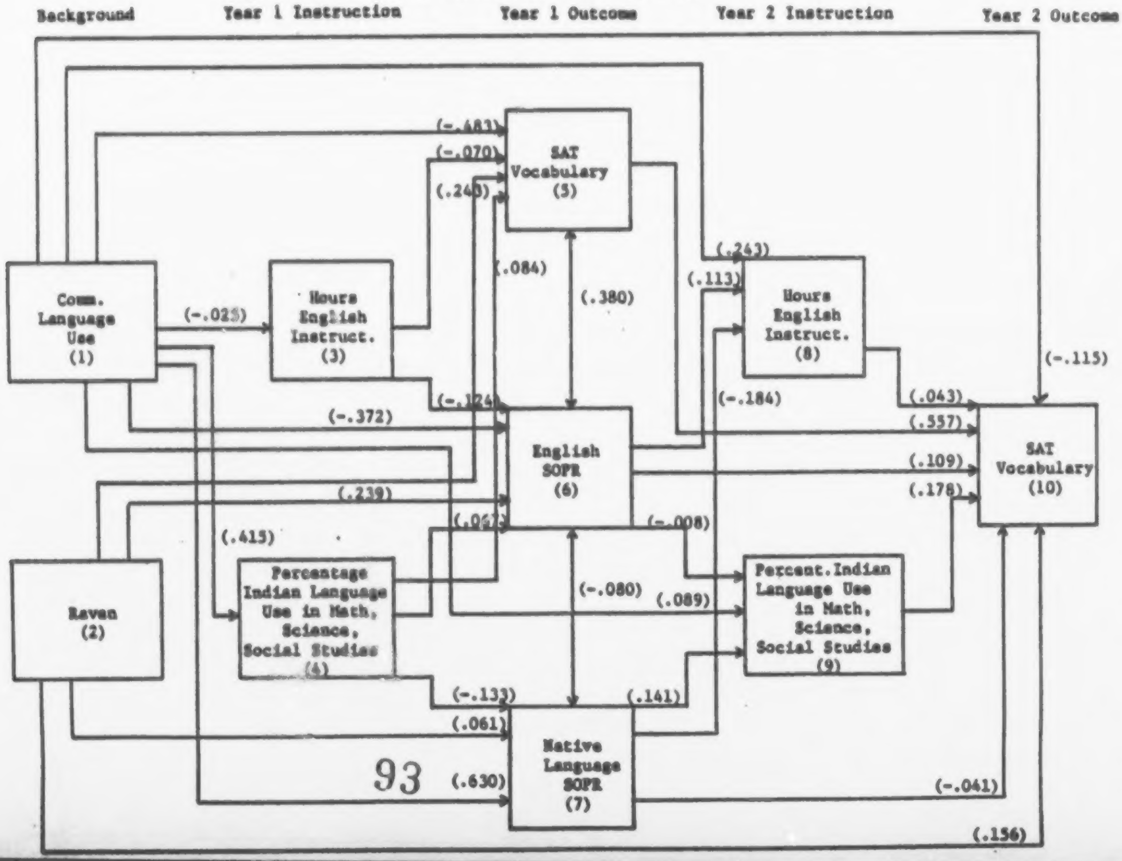

Background
Year 1 Instruction
Year 1 Outcome
Year 2 Instruction
Year 2 Outcome
Comm. Language Use (1)
Raven (2)
Hours English Instruct. (3)
Percentage Indian Language Use in Math, Science, Social Studies (4)
SAT Vocabulary (5)
English SOPR (6)
Native Language SOPR (7)
Hours English Instruct. (8)
Percent. Indian Language Use in Math, Science, Social Studies (9)
SAT Vocabulary (10)
(-.023)
(-.483)
(-.070)
(.243)
(.084)
(.380)
(-.124)
(-.372)
(.239)
(.415)
(.067)
(-.133)
(.061)
(.630)
(-.080)
(.243)
(.113)
(-.184)
(-.008)
(.089)
(.141)
(.043)
(-.115)
(.557)
(.109)
(.178)
(-.041)
(.156)

Figure C.5 Model for Math/Cohort A/(n=161)

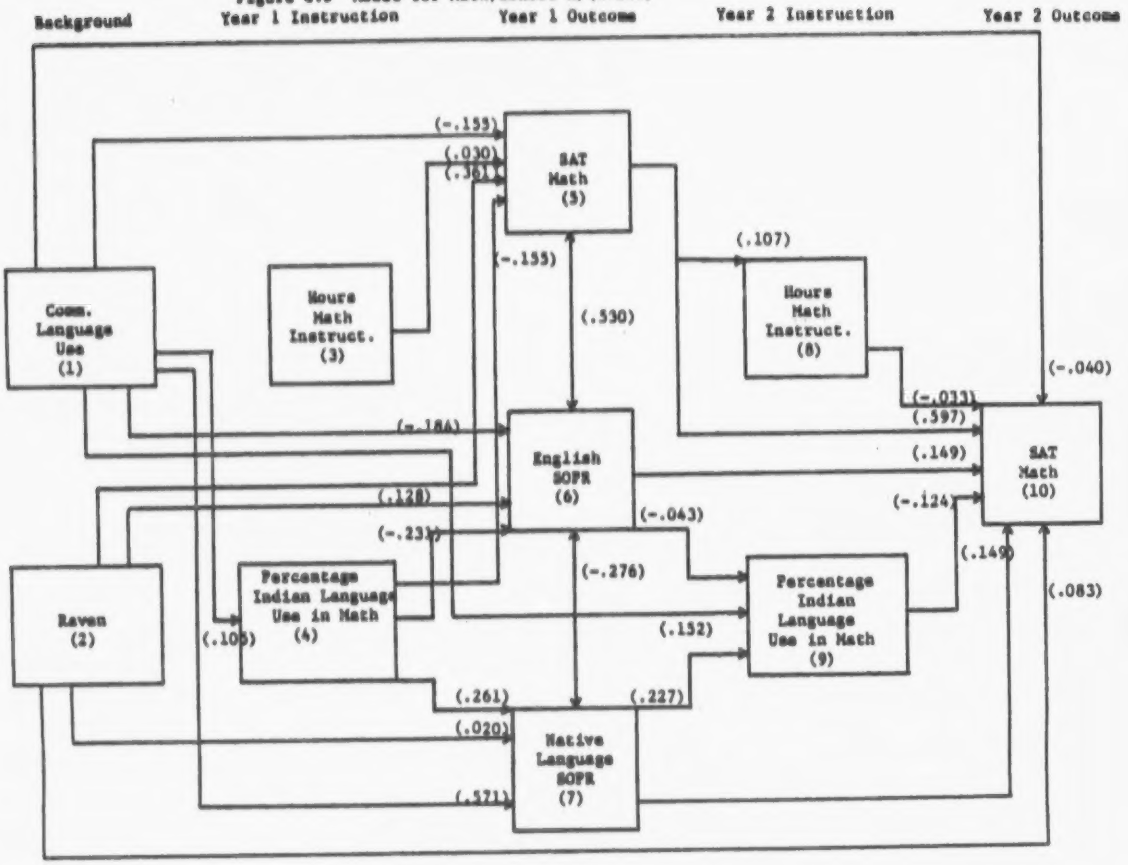
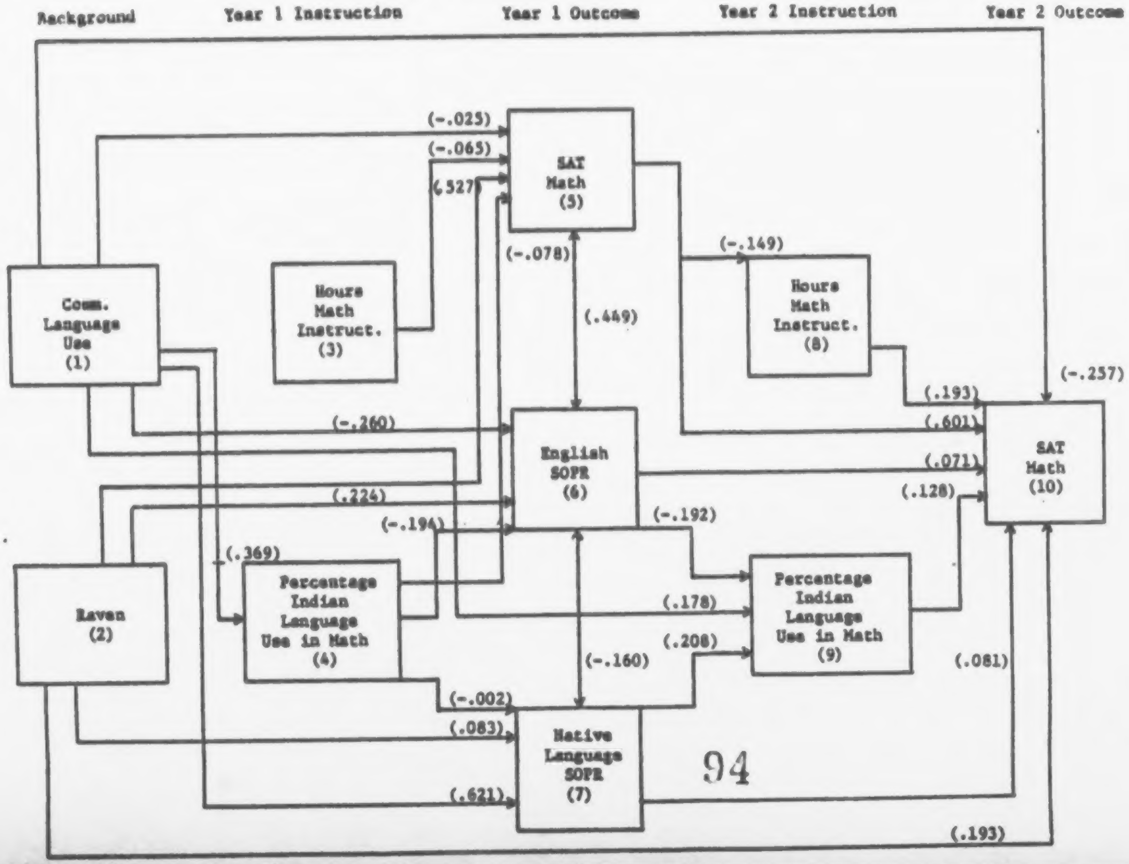

Background
Year 1 Instruction
Year 1 Outcome
Year 2 Instruction
Year 2 Outcome
Comm. Language Use (1)
Raven (2)
Hours Math Instruct. (3)
Percentage Indian Language Use in Math (4)
SAT Math (5)
English SOPR (6)
Native Language SOPR (7)
Hours Math Instruct. (8)
Percentage Indian Language Use in Math (9)
SAT Math (10)
(-.155)
(.030)
(.361)
(-.155)
(.530)
(.107)
(-.040)
(-.033)
(.597)
(.149)
(-.124)
(-.186)
(.128)
(-.231)
(-.043)
(-.276)
(.149)
(.083)
(.103)
(.152)
(.261)
(.227)
(.020)
(.571)

Figure C.6 Model for Math/Cohort B/(n=113)


Background
Year 1 Instruction
Year 1 Outcome
Year 2 Instruction
Year 2 Outcome
Comm. Language Use (1)
Raven (2)
Hours Math Instruct. (3)
Percentage Indian Language Use in Math (4)
SAT Math (5)
English SOPR (6)
Native Language SOPR (7)
Hours Math Instruct. (8)
Percentage Indian Language Use in Math (9)
SAT Math (10)
(-.025)
(-.065)
(.527)
(-.078)
(.449)
(-.149)
(-.257)
(.193)
(.601)
(.071)
(.128)
(-.260)
(.224)
(-.194)
(-.192)
(.369)
(.178)
(.208)
(-.160)
(.081)
(-.002)
(.083)
(.621)
(.193)

results made it appear to have. In preparation for these analyses, Tables C.6a, C.6b, and C.6c were provided, showing the means and standard deviations of SAT Vocabulary, Reading Comprehension, and Math respectively, for subgroups fairly homogeneous with respect to English SOPR (divided in 3 categories), Indian SOPR (4 categories), and percentage of time English is used in instruction (2 categories). The percentage-of-time variable, as in the case of the multiple regression analyses, is for math instruction when the criterion variable is SAT Math, and for math, science, social studies, and ethnic heritage instruction combined when the criterion variable is SAT Vocabulary or Reading Comprehension. Because for most students the Indian language was used relatively little, if at all, percentage of English use was dichotomized at 89% (a rather high point on the 0-to-100 scale).

Separately for each cohort for each year of the study (i.e., separately for each grade) an analysis of covariance of the percentage-of-time-in-English dichotomized variable was carried out for each of the subgroups homogeneous with respect to the English and Indian SOPRs. The two covariates used in the Year 1 analyses were (1) Raven total and (2) hours per week of instruction in English (in the case of the Vocabulary and Reading Comprehension criteria) or in math in the case of the Math criterion. For the Year 2 analyses there was also a third covariate, the year 1 SAT score corresponding to the criterion variable. The results of these 12 covariance analyses (3 criterion variables, 4 grades each) are summarized in Table C.7. In this table the F ratio, degrees of freedom (df), and significance level (p) are shown for each covariate, each main effect, and all interactions. The results for the most part confirm the multiple regression findings. The Raven is consistently significant (at the ".00" level, i.e., under .005) for all Year 1 analyses; in Cohort B it is also significant (at the .05 level or less) in the Year 2 analyses. It is perhaps noteworthy that number of hours per week of English instruction is sporadically significant at the .05 level (twice out of eight analyses) as is the corresponding value for math instruction (one out of four analyses), in spite of the generally negligible magnitude of the corresponding beta weights in Tables C.1a and C.1b. Like the Year 1 F values for English SOPR, the F values of SAT covariates in the Year 2 analyses are all significant at the ".00" level.

TABLE C.6a Means and standard deviations of S.A.T. Vocabulary for students classified on the basis of English SOPR, Indian SOPR, and percentage use of English language in teaching subjects other than language arts

						% of time English is used in instruction										
						89.0% or less					More than 89.0%					
						Indian SOPR					Indian SOPR					
Cohort	Year	Grade	SAT Battery and Form	Eng SOPR		4-12	13-17	18-22	23-25	Total	4-12	13-17	18-22	23-25	Total	TOTAL
A	1	1	Primary 1 Form F	23-25	M	20.60	24.57	19.50	20.50	22.00	26.08	21.67	24.33	26.50	25.56	24.33
					σ	5.90	2.99	.71	4.65	4.45	5.31	.58	6.66	4.95	5.16	5.17
					N	5	7	2	4	18	26	3	3	2	34	52
				18-22	M	19.47	18.35	19.46	19.20	19.05	20.90	19.80	18.46	23.00	19.73	19.39
					σ	5.41	4.49	6.35	2.95	5.14	4.55	4.47	4.22	2.83	4.43	4.79
					N	19	20	13	5	57	20	10	24	2	56	113
				5-17	M	15.38	13.89	14.40	16.20	14.97	15.09	15.89	14.00	15.14	15.19	15.07
					σ	3.74	4.17	2.95	3.05	3.45	2.21	3.44	2.94	2.73	2.74	3.13
					N	8	9	10	10	37	11	9	4	7	31	68
				Total	M											19.23
					σ											5.54
					N											233
A	2	2	Primary 2 Form E	23-25	M	20.14	18.75	18.50	15.00	18.63	20.10	18.75	24.33	—	20.36	19.73
					σ	5.76	3.59	3.54	5.29	4.91	6.22	6.70	5.13	—	6.15	5.73
					N	7	4	2	3	16	21	4	3	0	28	44
				18-22	M	17.82	16.17	13.64	13.80	15.62	16.95	18.89	15.95	16.00	16.86	16.32
					σ	3.37	3.24	3.11	2.49	3.51	4.22	3.76	4.89	—	4.44	4.09
					N	11	12	11	5	39	20	9	21	1	51	90
				5-17	M	13.50	12.67	11.00	14.91	13.13	14.25	14.14	13.00	16.00	14.24	13.51
					σ	2.27	2.52	2.40	3.42	3.11	3.77	4.95	—	—	3.96	3.43
					N	8	3	10	11	32	8	7	1	1	17	49
				Total	M											16.39
					σ											4.90
					N											183
B	1	3	Primary 3 Form F	23-25	M	18.50	12.00	11.50	16.33	14.78	18.50	20.67	18.00	17.20	18.40	17.44
					σ	.71	.00	7.78	4.16	4.58	5.89	7.02	6.16	6.26	5.82	5.68
					N	2	2	2	3	9	12	3	5	5	25	34
				18-22	M	15.58	17.82	15.92	17.00	16.43	17.06	12.33	12.60	12.90	14.76	15.63
					σ	5.73	3.09	4.83	2.83	4.58	6.39	5.51	2.88	3.67	5.47	5.06
					N	12	11	12	2	37	16	3	5	10	34	71
				5-17	M	11.00	11.60	14.00	17.00	12.29	20.00	10.00	9.00	10.60	10.62	11.48
					σ	1.10	3.21	—	2.83	2.97	—	1.41	4.58	1.95	4.11	3.60
					N	6	5	1	2	14	1	2	5	5	13	27
				Total	M											15.25
					σ											5.35
					N											132
B	2	4	Inter 1 Form E	23-25	M	19.50	18.33	23.50	19.67	20.00	16.82	20.33	14.80	17.20	16.92	17.82
					σ	3.54	11.02	6.36	5.03	6.50	6.52	6.11	2.68	4.38	5.37	5.80
					N	2	3	2	3	10	11	3	5	5	24	34
				18-22	M	10.13	16.80	14.75	12.33	13.78	18.10	12.67	16.83	13.00	16.69	15.30
					σ	3.56	4.49	3.88	4.37	4.72	6.30	6.03	6.62	3.08	6.14	5.66
					N	8	10	8	6	32	21	3	6	5	35	67
				5-17	M	10.00	13.20	9.33	11.00	11.45	11.40	13.00	14.00	9.40	10.92	11.17
					σ	—	8.76	3.79	5.66	6.31	3.29	—	—	2.19	2.84	4.72
					N	1	5	3	2	11	5	1	1	5	12	23
				Total	M											15.23
					σ											5.93
					N											124

TABLE C.6b Means and standard deviations of S.A.T. Reading Comprehension for students classified on the basis of English SOPR, Indian SOPR, and percentage use of English language in teaching subjects other than language arts

Cohort	Year	Grade	SAT Battery and Form	Eng SOPR		% of time English is used in instruction										
						89.0% or less					More than 89.0%					
						Indian SOPR					Indian SOPR					
						4-12	13-17	18-22	23-25	Total	4-12	13-17	18-22	23-25	Total	TOTAL
A	1	1	Primary 1 Form F	23-25	M	24.80	31.43	35.00	27.50	29.11	30.12	19.67	31.67	37.50	29.76	29.34
					σ	7.46	9.24	5.66	6.81	8.10	7.90	3.06	10.41	.71	8.23	8.11
					N	5	7	2	4	18	26	3	3	2	34	52
				18-22	M	21.26	20.30	24.69	26.60	22.18	24.00	23.00	25.08	20.50	24.16	23.16
					σ	9.22	6.42	8.08	9.86	8.19	7.50	6.88	6.61	2.12	6.83	7.58
					N	19	20	13	5	57	20	10	24	2	56	113
				5-17	M	14.13	19.11	17.30	20.40	17.89	17.91	17.89	18.25	20.00	18.42	18.13
					σ	4.32	7.36	6.33	7.12	6.61	5.19	5.88	5.68	4.90	5.19	5.97
					N	8	9	10	10	37	11	9	4	7	31	68
				Total	M											23.12
					σ											8.31
					N											233
A	2	2	Primary 2 Form E	23-25	M	25.43	21.50	27.00	24.67	24.50	25.19	23.75	35.33	—	26.07	25.50
					σ	10.60	13.30	2.83	6.03	9.45	8.13	11.70	1.53	—	8.68	8.89
					N	7	4	2	3	16	21	4	3	0	28	44
				18-22	M	23.09	19.08	18.27	20.60	20.18	22.55	19.22	23.00	22.00	22.12	21.27
					σ	8.13	6.89	5.14	7.09	6.88	9.37	7.66	7.43	—	8.18	7.66
					N	11	12	11	5	39	20	9	20	1	50	89
				5-17	M	15.62	19.50	11.20	18.09	15.58	15.75	14.86	10.00	11.00	14.76	15.30
					σ	4.47	7.51	4.54	7.87	6.70	6.63	4.06	—	—	5.31	6.22
					N	8	4	10	11	33	8	7	1	1	17	50
				Total	M											20.66
					σ											8.44
					N											183
B	1	3	Primary 3 Form F	23-25	M	42.67	31.00	35.00	40.86	38.73	36.77	39.00	34.40	37.40	36.69	37.44
					σ	3.06	5.66	15.59	7.73	9.00	11.18	18.03	7.50	9.71	10.58	9.97
					N	3	2	3	7	15	13	3	5	5	26	41
				18-22	M	23.83	33.33	28.93	30.67	28.98	29.69	22.33	27.00	28.40	28.56	28.79
					σ	6.32	8.90	11.28	9.20	9.59	11.18	9.02	9.38	7.21	9.55	9.51
					N	12	12	14	6	44	16	3	5	10	34	78
				5-17	M	20.83	19.20	27.00	18.83	20.06	30.00	17.50	19.80	19.00	19.92	20.00
					σ	4.54	.84	—	6.11	4.58	—	7.78	10.33	4.18	7.50	5.87
					N	6	5	1	6	18	1	2	5	5	13	31
				Total	M											29.34
					σ											10.80
					N											130
B	2	4	Inter 1 Form E	23-25	M	43.00	43.33	36.50	43.33	41.90	37.15	47.00	37.33	38.78	38.61	39.41
					σ	1.41	9.29	12.02	14.01	9.34	12.03	8.89	8.71	7.90	10.04	9.86
					N	2	3	2	3	10	13	3	6	9	31	41
				18-22	M	22.38	30.40	31.10	36.80	30.58	31.71	32.50	30.57	24.25	30.75	30.66
					σ	7.29	8.40	11.64	10.23	10.52	12.10	6.25	12.09	9.95	11.24	10.80
					N	8	10	10	10	38	21	4	7	4	36	74
				5-17	M	23.00	24.00	24.33	26.33	24.93	23.00	28.00	29.00	20.40	22.83	24.00
					σ	—	3.39	7.64	11.02	7.52	5.48	—	—	4.62	5.22	6.36
					N	1	5	3	6	15	5	1	1	5	12	27
				Total	M											31.92
					σ											11.19
					N											142

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TABLE C.6c Means and standard deviations of S.A.T. Math Total for students classified on the basis of English SOPR, Indian SOPR, and percentage use of English language in teaching math

Cohort	Year	Grade	SAT Battery and Form	Eng SOPR		% of time English is used in instruction										
						89.0% or less					More than 89.0%					
						Indian SOPR					Indian SOPR					
						4-12	13-17	18-22	23-25	Total	4-12	13-17	18-22	23-25	Total	TOTAL
A	1	1	Primary 1 Form F	23-25	M	52.25	55.57	72.00	61.00	56.31	56.63	61.00	57.25	45.75	55.89	56.00
					σ	9.71	7.93	—	—	9.17	11.35	8.89	9.57	7.68	10.99	10.47
					N	4	7	1	1	13	27	3	4	4	38	51
				18-22	M	47.11	44.70	48.15	52.20	47.66	49.22	52.86	50.71	44.00	50.28	48.68
					σ	13.41	8.01	11.66	8.23	10.76	13.14	9.99	7.00	—	10.26	10.60
					N	19	23	20	5	67	18	7	17	1	43	110
				5-17	M	35.61	38.75	40.57	44.56	40.03	37.00	35.38	32.75	31.50	35.31	37.67
					σ	9.33	10.24	13.07	12.38	11.38	8.34	11.04	7.09	3.54	9.13	10.50
					N	9	4	7	9	29	10	13	4	2	29	58
				Total	M											47.47
					σ											12.39
					N											219
A	2	2	Primary 2 Form E	23-25	M	47.00	57.50	61.00	61.00	57.50	64.63	72.60	69.00	47.00	65.70	64.56
					σ	—	31.82	—	2.83	15.28	18.56	21.40	14.63	—	18.33	18.00
					N	1	2	1	2	6	27	5	4	1	37	43
				18-22	M	84.00	63.50	53.14	—	58.30	57.10	56.88	59.90	64.20	58.36	58.35
					σ	—	12.02	16.31	—	17.13	17.39	10.93	12.33	9.09	14.07	14.36
					N	1	2	7	0	10	29	17	21	5	72	82
				5-17	M	49.25	37.00	41.71	53.75	47.80	41.89	42.22	43.00	54.00	43.70	45.60
					σ	6.34	—	12.65	16.29	13.77	18.45	11.60	12.73	3.61	14.07	13.92
					N	4	1	7	8	20	9	9	2	3	23	43
				Total	M											56.68
					σ											16.71
					N											168
B	1	3	Primary 3 Form F	23-25	M	63.33	69.00	74.00	69.86	69.27	68.75	83.33	63.40	63.40	68.36	68.70
					σ	10.41	15.56	7.00	11.45	10.42	13.25	11.02	12.88	22.20	15.45	13.64
					N	3	2	3	7	15	12	3	5	5	25	40
				18-22	M	61.58	66.17	62.71	60.33	63.02	58.86	37.67	47.00	66.44	57.10	60.57
					σ	9.54	10.65	13.03	9.97	10.93	18.40	24.79	17.20	19.84	20.36	15.69
					N	12	12	14	6	44	14	3	5	9	31	75
				5-17	M	42.33	46.75	39.00	55.67	47.88	49.00	29.00	42.60	46.00	42.31	45.47
					σ	14.64	14.20	—	16.67	15.20	—	4.24	23.35	14.83	17.19	16.05
					N	6	4	1	6	17	1	2	5	5	13	30
				Total	M											59.69
					σ											17.14
					N											145
B	2	4	Inter 1 Form E	23-25	M	—	66.00	71.00	72.67	70.29	64.83	76.00	67.40	64.20	66.56	67.38
					σ	—	14.14	9.90	29.69	18.78	15.87	20.07	4.67	12.21	13.84	14.79
					N	0	2	2	3	7	12	3	5	5	25	32
				18-22	M	44.20	58.67	51.10	61.33	54.07	56.74	59.60	61.50	57.50	58.13	56.27
					σ	19.52	30.01	22.20	22.32	22.24	21.29	7.57	17.92	4.95	18.08	20.01
					N	5	3	10	9	27	19	5	6	2	32	59
				5-17	M	48.00	37.75	53.33	55.17	49.13	34.67	49.00	—	34.25	36.25	44.83
					σ	19.92	14.66	16.65	25.13	19.91	19.50	—	—	13.77	14.71	19.05
					N	3	4	3	6	16	3	1	0	4	8	24
				Total	M											56.97
					σ											19.95
					N											115

TABLE C.7 Analysis of covariance** of SAT Vocabulary, Reading Comprehension, and Math Total (corresponding to data of Tables C.6a, C.6b, and C.6c)*

Row #	Sources of Variances	SAT VOCABULARY											
		COHORT A						COHORT B					
		Year 1 Grade 1			Year 2 Grade 2			Year 1 Grade 3			Year 2 Grade 4		
		F	df	p	F	df	p	F	df	p	F	df	p
	Covariates												
1	Raven Total	8.63	1	.00	.38	1	.54	11.40	1	.00	4.21	1	.04
	Hrs/wk instruction												
2a	o English	16.47	1	.00	.10	1	.76	.02	1	.90	2.45	1	.1
2b	o Math												
3	Yr. 1 SAT score	—	-	—	139.44	1	.00	—	-	—	87.50	1	.0
	Main Effects												
4	A. English SOPR	47.04	2	.00	1.08	2	.34	7.13	2	.00	2.29	2	.11
5	B. Indian SOPR	1.13	3	.34	.72	3	.54	1.51	3	.22	.59	3	.6
	C. % English used in instruction in:												
6a	o Non-Language arts	4.53	1	.03	.51	1	.48	.69	1	.41	.76	1	.3
6b	o Math												
	Interactions												
7	AB	.33	6	.92	2.37	6	.03	.19	6	.97	.50	6	.81
8	AC	.31	2	.27	.19	2	.82	2.92	2	.06	5.29	2	.01
9	BC	.21	3	.89	.42	3	.74	2.06	3	.11	1.85	3	.14
10	ABC	.52	6	.17	.48	5	.79	1.87	6	.09	1.67	6	.14
11	Residual variance		207			157			106			97	
12	TOTAL		232			182			131			123	

* Numbers of cases

Cohort	N
A	168-233
B	115-150

See Tables C.6a, C.6b, and C6.c for details

** Each of the 12 analyses of covariance is based on listwise data.

Table C.7 (Cont.)

SAT READING COMPREHENSION												
COHORT A						COHORT B						
Year 1 Grade 1			Year 2 Grade 2			Year 1 Grade 3			Year 2 Grade 4			Row #
F	df	p	F	df	p	F	df	p	F	df	p	
10.05	1	.00	2.94	1	.09	28.82	1	.00	4.25	1	.04	1
3.44	1	.06	.21	1	.65	.53	1	.47	8.62	1	.00	2a
												2b
—	-	—	240.33	1	.00	—	-	—	127.02	1	.00	3
33.02	2	.00	1.12	2	.33	23.02	2	.00	1.14	2	.32	4
1.79	3	.15	1.62	3	.19	.06	3	.98	.12	3	.95	5
1.91	1	.17	2.02	1	.16	.79	1	.38	.80	1	.37	6a
											.17	6b
.53	6	.78	1.78	6	.11	.66	6	.68	.80	6	.57	7
.06	2	.94	.89	2	.41	.60	2	.55	.23	2	.80	8
.77	3	.51	.19	3	.90	1.03	3	.38	1.77	3	.16	9
1.84	6	.09	.90	5	.48	1.61	6	.15	.66	6	.68	10
207			157			124			115			11
232			182			149			141			12

SAT MATH TOTAL												
COHORT A						COHORT B						
Year 1 Grade 1			Year 2 Grade 2			Year 1 Grade 3			Year 2 Grade 4			Row #
F	df	p	F	df	p	F	df	p	F	df	p	
44.22	1	.00	2.44	1	.12	66.29	1	.00	5.34	1	.02	1
												2a
.08	1	.78	.03	1	.82	.19	1	.67	18.17	1	.00	2b
—	-	—	123.62	1	.00	—	-	—	79.16	1	.00	3
35.58	2	.00	1.69	2	.19	12.89	2	.00	.68	2	.51	4
.17	3	.91	.26	3	.86	.20	3	.90	.26	3	.86	5
												6a
1		.68	.39	1	.53	1.28	1	.25	.58	1	.45	6b
.30	6	.94	.89	6	.50	.96	6	.46	.60	6	.72	7
.69	2	.50	.36	2	.10	1.27	2	.28	.43	2	.65	8
.90	3	.44	.58	3	.63	2.04	3	.11	.64	3	.39	9
.92	6	.48	.80	5	.55	1.24	6	.29	1.37	4	.25	10
193			142			119			90			11
218			167			144			114			12

As for the main effects, all of the year 1 values of F for English SOPR are significant at the ".00" level. It thus appears that English SOPR plays somewhat the same role in Year 1 as the SAT variables play in the Year 2 analyses. None of F values for Indian SOPR are significant at the .05 level. In regard to the percentage-of-time-in-English variable, only one of 12 F values (Vocabulary, grade 1) is significant. The percentage-of-time variable for the Vocabulary criterion, it will be recalled, is percentage of English in math, science, and social studies instruction. That it has a significant F ratio just for grade 1 is probably due to the fact that it is in grade 1 that the students' English is poorest, and that therefore the benefit they receive from hearing English used routinely is greatest. This interpretation is supported by the direction of the relationship between vocabulary and the percentage-in-English variable; the correlation (for the Vocabulary Grade 1 analysis) is a substantial negative one (-.283).

Rather surprisingly, the language used in math instruction appears to be somewhat irrelevant with respect to math achievement; none of the four F ratios even comes close to significance. Perhaps the advantages and disadvantages of using the Indian language cancel each other out.

As for the interactions, there are only sporadic instances of statistical significance (2 out of 48, both of them occurring for the Vocabulary criterion); we attach no particular importance to them.

C.2d FOCUSED SUBGROUP ANALYSIS

The three preceding sections of this appendix (i.e., the sections on regression analysis, path analysis, and covariance analysis) dealt with statistical analyses based on all available cases. Now we turn to a set of analyses in which each analysis is based on a tightly defined mutlidimensionally homogeneous group of cases, which is split into two subgroups differing in one important dimension: the percentage of instruction that is presented in English. These analyses really amount in effect to a modification and simplification of the covariance analysis approach described above. We compare it to covariance analysis because it considers the results for homogeneous subgroups. But instead of making the groups homogeneous with respect to a particular variable by statistical control (i.e., using the variable as a covariate) it was accomplished directly, by classifying the students on that variable. More specifically, this fourth approach, as applied in the present instance, consisted in obtaining criterion means for subgroups homogeneous with respect to four dichotomized variables: English SOPR, Indian SOPR, Raven, and percentage-use-of-English-in-instruction, this last-named variable again being for instruction in math, science, and social studies in the case of the Vocabulary and Reading Comprehension criterion variables, and for instruction in math in the case of the Math criterion. Thus this approach is about the same as that resulting in Tables C.6a, C.6b, and C.6c, except that in those tables the SOPRs had more than two categories each, and Raven was not a classification variable. The final step in these focused subgroup analyses was to compare criterion variable means on subgroups paired in such a way that the pair is homogeneous on the SOPRS and the Raven, but one subgroup of the pair is high and the other low, on the dichotomized percentage-of-use-of-English variable. Table C.8a, shows the Vocabulary and Reading Comprehension results for the 4-way breakdown of cases; Table C.8b shows the corresponding data for Math. It will be noted that the subgroups are organized into the pairs to be compared.

These two tables permit exploration of the following three hypotheses.

1. For the Vocabulary criterion

   Students will learn more English vocabulary if English is used when they are being taught math, science, and social studies than if some other language is used.

2. For the Reading Comprehension criterion

   Students will improve their English reading skills more if English is used in the course of their math, science, and social studies instruction than if some other language is used.

TABLE C.8a Means and standard deviations of Year 1 SAT Vocabulary and Reading Comprehension for students classified on the basis of SOPR scores, Raven, and percentage use of the English language in teaching math, science, and social studies

Note: All of the classification variables have been dichotomized into a "plus" category and a "minus" category*

Cohort	Grade	Eng. SOPR	Ind. SOPR	Raven	N	% use English	SAT Vocab.			SAT Rdg. Comp.			Pair #
							M	σ	N	M	σ	N	
A	1	+	+	+	27	+	21.1	4.7	16	25.9	8.7	16	1V
						-	17.4	2.9	11	24.6	7.1	11	
		+	+	-	18	+	19.6	5.4	11	27.8	6.3	11	2V
						-	23.1	6.1	7	29.7	10.5	7	
		+	-	+	57	+	24.2	5.4	37	27.4	8.6	37	3V
						-	20.9	5.3	20	24.0	9.0	20	
		+	-	-	49	+	21.0	5.4	20	24.6	6.9	20	4V
						-	20.2	4.7	29	23.6	8.8	29	
		-	+	+	16	+	14.8	1.7	4	18.8	6.9	4	5V
						-	16.2	3.6	12	22.0	7.4	12	
		-	+	-	18	+	14.7	3.3	7	20.6	4.6	7	6V
						-	14.5	2.6	11	16.2	3.4	11	
		-	-	+	15	+	15.6	3.3	7	20.3	6.5	7	7V
						-	14.2	4.3	8	17.9	7.4	8	
		-	-	-	33	+	16.1	3.1	19	18.3	5.4	19	8V
						-	15.1	4.3	14	15.8	4.7	14	
B	3	+	+	+	22	+	14.5	5.9	10	33.2	6.9	10	1R
						-	16.2	3.7	12	35.8	11.7	17	
		+	+	-	15	+	12.5	3.7	4	29.0	13.0	4	2R
						-	15.3	4.0	11	30.4	8.5	15	
		+	-	+	30	+	20.1	6.0	15	38.4	12.0	16	3R
						-	17.4	5.2	15	31.0	9.2	16	
		+	-	-	32	+	16.1	6.5	13	26.3	10.2	13	4R
						-	15.3	4.7	19	29.0	9.9	20	
		-	+	+	4	+	15.5	7.8	2	30.0	14.1	2	5R
						-	11.5	4.9	2	22.2	8.5	6	
		-	+	-	10	+	9.7	3.1	6	20.7	6.7	6	6R
						-	14.0	3.7	4	18.2	4.6	6	
		-	-	+	3	+	-	-	0	-	-	0	7R
						-	12.3	4.0	3	23.3	12.9	3	
		-	-	-	16	+	11.8	5.2	6	22.2	9.5	6	8R
						-	11.8	2.3	10	22.6	5.7	10	

*The classification variables are dichotomized as follows:

	"Minus" category	"Plus" category
English SOPR	5-18	19-25
Indian SOPR	4-18	19-25
Raven		
CPM (Cohort A)	0-20	21-36
SPM (Cohort B)	0-28	29-60
% use of English		
In Cohort A	Up to 89.0%	More than 89.0%
In Cohort B	Up to 88.0%	More than 88.0%

**Percentage use of English in teaching math, science, and social studies.

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TABLE C.8b Means and standard deviations of Year 1 SAT Math Total for students classified on the basis of SOPR scores, Raven, and percentage use of the English language in teaching math

Note: All of the classification variables have been dichotomized into a "plus" category and a "minus" category*

Eng. SOPR	Ind. SOPR	Raven	% use of English**	SAT Math Total						Pair #
				Cohort A - Grade 1			Cohort B - Grade 3			
				M	σ	N	M	σ	N	
+	+	+	+	51.5	10.8	19	68.4	15.6	15	1
			-	54.3	7.3	7	69.4	13.4	11	
+	+	+	+	49.3	11.3	17	44.0	9.7	5	2
			-	49.3	11.3	17	60.1	9.1	14	
+	-	+	+	56.3	10.1	49	72.1	14.6	19	3
			-	50.3	8.0	7	68.5	11.9	12	
+	-	-	+	51.2	11.0	30	51.8	15.3	12	4
			-	42.4	9.2	18	62.6	9.8	19	
-	+	+	+	41.2	11.6	5	49.7	31.6	3	5
			-	50.2	8.4	6	59.4	18.5	5	
-	+	-	+	37.8	9.7	9	41.2	13.3	8	6
			-	35.6	12.5	5	49.8	8.5	4	
-	-	+	+	41.0	9.7	10	-	-	0	7
			-	47.0	7.4	5	60.7	12.0	3	
-	-	-	+	35.6	9.4	25	44.9	24.7	7	8
			-	32.4	9.9	7	41.5	14.1	8	

---

*The classification variables are dichotomized as follows:

	"Minus" category	"Plus" category
English SOPR	5-18	19-25
Indian SOPR	4-18	19-25
Raven		
CPM (Cohort A)	0-20	21-36
SPM (Cohort B)	0-28	29-60
% use of English	Up to 89.0%	More than 89.0%

**Percentage use of English in teaching math.

3. For the Math criterion

> Students will learn math better if they are taught it in a language they understand well than if the instruction is presented in a language in which their proficiency is limited. (In connection with this hypothesis it should be recognized that to the extent that the hypothesis is supported for math, it can reasonably be inferred by extension that analogous hypotheses regarding the language of instruction for teaching science and social studies would also be supported.)

To check on whether this third hypothesis is supported by the empirical data, it is necessary to know in which language - English or an Indian language - the students are more proficient in their speech and comprehension of the spoken language. Since the same five scales (Comprehension, Fluency, Vocabulary, Pronunciation, and Grammar) were used on the two SOPRs, and since the wording of each of the five 5-point scales was identical for the two SOPRs, dichotomizing the two SOPRs at exactly the same point makes it reasonable to assume that if a student is in the high category on one and the low category on the other, he (she) has a better command of the language for which his SOPR is in the high category. Therefore in the case of the Math criterion, pairs 3,4,5, and 6 on Table C.8b - i.e., the four pairs for which one of the two SOPRs is high and the other low - are critical in determining whether there is any evidence in support of hypotheses 3, stated above. For the other two criterion variables (Vocabulary and Reading Comprehension) all eight kinds of pairs shown in Table C.8a are relevant. Therefore for the Vocabulary and Reading Comprehension criteria the Cohort A and Cohort B results are summarized in Table C.9 for all eight kinds of pairs. For the math criterion, Table C.9 includes only the data for the four critical pairs (#3, #4, #5, and #6).

For both the Vocabulary criterion and the Reading Comprehension criterion there are 15 critical comparisons - (15 pairs with data for each category of the dichotomy on percentage use of English). For the Math criterion there are only 8 critical comparisons (four kinds of pairs, two cohorts for each). As shown in the bank of three columns at the right of Table C.9, 9.5 of the 15 comparisons (a tie was counted as .5) for the Vocabulary criterion, 9 of the 15 for Reading Comprehension, and 6 of the 8 for Math turn out to support the

TABLE C.9 Checking the Table C.8a and C.8b data against three hypotheses

Hypothesis 1. Vocabulary scores are higher if instruction in math, science and social studies is mostly in English than if another language is used extensively.

Hypothesis 2. Reading Comprehension scores are higher if instruction in math, science, and social studies is mostly in English than if another language is used extensively.

Hypothesis 3. Math scores are higher if math instruction is mostly in a language the student understands well than if another language is used extensively.

				*		I-use-of-English category — high (+) or low (-) — for which the mean criterion score								
						is the higher of the two			should be the higher one according to hypothesis			Are the results in line with the hypothesis?		
Cohort	Grade	Row #	English SOPE	Indian SOPE	Raven	Voc.	Rdg.	Math	Voc.	Rdg.	Math	Voc.	Rdg.	Math
A	1	A1	+	+	+	hi	hi		hi	hi		yes	yes	
		A2	+	+	-	lo	lo		hi	hi		no	no	
		A3	+	-	+	hi	hi	hi	hi	hi	hi	yes	yes	yes
		A4	+	-	-	hi	hi	hi	hi	hi	hi	yes	yes	yes
		A5	-	+	+	lo	lo	lo	hi	hi	lo	no	no	yes
		A6	-	+	-	hi	hi	hi	hi	hi	lo	yes	yes	no
		A7	-	-	+	hi	hi		hi	hi		yes	yes	
		A8	-	-	-	hi	hi		hi	hi		yes	yes	
B	3	B1	+	+	+	lo	lo		hi	hi		no	no	
		B2	+	+	-	lo	lo		hi	hi		no	no	
		B3	+	-	+	hi	hi	hi	hi	hi	hi	yes	yes	yes
		B4	+	-	-	hi	lo	lo	hi	hi	hi	yes	no	no
		B5	-	+	+	hi	hi	lo	hi	hi	lo	yes	yes	yes
		B6	-	+		lo	hi	lo	hi	hi	lo	no	yes	yes
		B7	-	-	+	-	-		hi	hi		-	-	
		B8	-	-	-	=	lo		hi	hi		?	no	
No. of pairs for which comparison data are available												15	15	8
No. of pairs which fit the hypothesis												9.5**	9	6

*Identified as in Tables C.8a and C.8b.

**A tie is counted as .5.

corresponding hypotheses: hypothesis 1 for Vocabulary, hypotheses 2 for Reading Comprehension, and hypothesis 3 for Math. Thus the hypotheses are supported, though by no means proven, by the Table C.9 data. The results, though in the right direction for supporting the hypotheses, are not significantly different from chance. It is important to recognize that alternative hypotheses could almost certainly be formulated with which the empirical data would be at least as compatible.

C.3

3. SUMMARY OF FINDINGS AND IMPLICATIONS

Two of the main findings of the analyses described in this appendix are (1) that the best predictors of achievement are some of the initial status variables - the Raven, the English SOPR, and previous scores on the SAT - and (2) that the instructional variables investigated (amount of instruction in specific subjects, and language of instruction) are not significantly related to outcomes (or at least that significant relationships were not manifested in the sample studied).

The English SOPR turns out to be an even better indicator of how well the children in this study will do in school (as measured by three SAT subtests - Vocabulary, Reading Comprehension, and Mathematics) than the measure of academic aptitude used - the Raven Progressive Matrices test. This is somewhat contrary to the usual situation in which academic performance is being predicted. Not surprisingly, in educational research the best predictor of academic performance is typically found to be academic aptitude. The somewhat different findings of the present study are in line with expectation, however; they are undoubtedly a consequence of the fact that so many of the students in the study fall in the limited-English-proficient category. These students thus are not able to perform at the level that would otherwise be expected on the basis of their academic potential (as indicated by the academic aptitude test). It seems reasonable to suppose that as the children progress through school, and as their English improves, the Raven will steadily become a better predictor and the importance of the English SOPR will decline. Indeed that process is already under way as revealed by a comparison of the Cohort A and Cohort B correlations of the Raven with criterion data (these r's are considerably higher for Cohort B, which is two years further along in school) and a similar comparison of cohorts on the English SOPR correlations (which are somewhat lower for Cohort B than A).

The Indian SOPR does not appear to be closely related to achievement but what relationships there are, both in terms of regression weights and correlation coefficients, tend to be largely negative.

In line with the well-known aphorism that past performance is the best predictor of future performance we have found that the year 1 score on an SAT test is an excellent predictor of the year 2 SAT score on the same subject. In the year 2 multiple regression analyses, in which it was feasible to incorporate year 1 SAT scores as independent variables, they supplanted English SOPR and the best predictors.

However the past-status and past-performance variables we have been talking about in this section - i.e., Raven, SOPRs, previous SAT's - do not account for all the variance. As a matter of fact, as can be seen from Table C.2 by adding up the values in the $\triangle$ columns (i.e., the percentages of variance accounted for) for all rows except instructional variables, only about 45 to 65 percent of the year 2 SAT variance is accounted for. If a modest percentage is added for the effects of home and family variables that are independent of the variables already taken into account, that leaves a substantial percentage unaccounted for. In other words there is plenty of room for instructional variables to have an effect. The effect they are having, however, appears to be surprisingly slight. Our investigation of the effects of number of hours of instruction, and choice of language in which to present instruction, showed some differences, but generally they were not large enough to be statistically significant.

What should be concluded from the failure to demonstrate statistical significance for findings concerning instructional methodology? One view, probably an unduly pessimistic one, is that nothing the schools do matters - that whether the child is successful in school is almost wholly determined by conditions beyond the school's or teacher's control.

A second explanation and probably an important one, of the failure to show statistically significant effects for instructional methodology variables is the fact that so little of the instruction is presented in the Indian language. (The grade 1 median is only about 10 percent.)

As for the independent variables in such categories as "school variables" and "teachers variables" (categories from which the instructional methodology variables discussed above have been excluded), their correlations with the criterion measures (achievement test scores) tend to be either low or unstable.

Among the home-and-family variables the ones that have the highest correlations with the criterion variables are: (1) parent's use of English in the home, (2) the amount of time the child devotes to reading (apart from homework assignments) and (3) parental expectations regarding how far the child will go in school.

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